STATISTICAL PANORAMA

FORECASTS

Air conditioning: A solid turnaround in single-family home starts, a modest upturn in consumer confidence to help replacement and add-on sales, and reasonable interest rates should push 1992 unitary shipments up 5% to 3,960,000 units.

Heat pumps: Although many of the positive factors affecting comfort cooling, including continued utility incentives, will carry over to heat pumps, an abnormally high field inventory will shave the increase to 3%, or 787,000 units.

Furnaces: Despite a flat oil furnace market and a modest increase in electric units, the over-production of gas furnaces with sub-minimum efficiencies in late 1991 will keep residential furnace shipments down 1%, to 2,412,000 units.

Boilers: Replacements and efficiency upgrades are positive factors for this market segment, which has been battered by a steady decline in new home starts in its prime Northeast market. We expect a 5% drop this year, however, to 281,500 units.

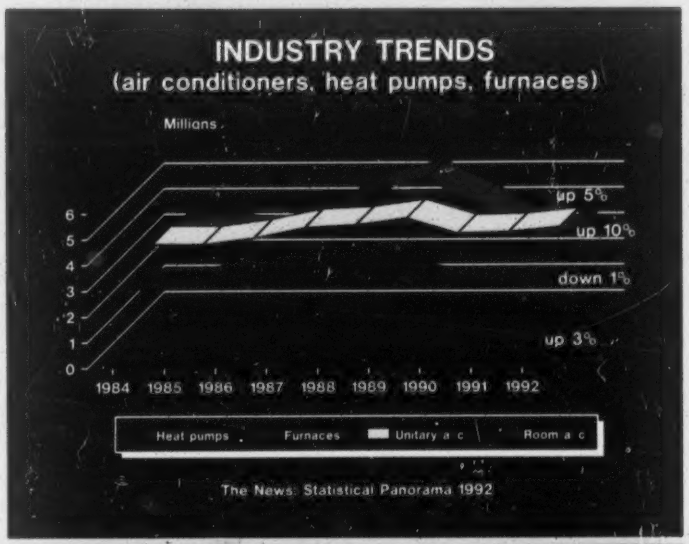
Chillers: Continued strength in the reciprocating chiller market and exports of centrifugal units should make up for the weakness in large commercial construction, holding this segment even at 15,200 units.

Room air conditioners: With inventories under better control and normal summer weather, this volatile market should increase by 10% to 3.1 million units — maybe more.

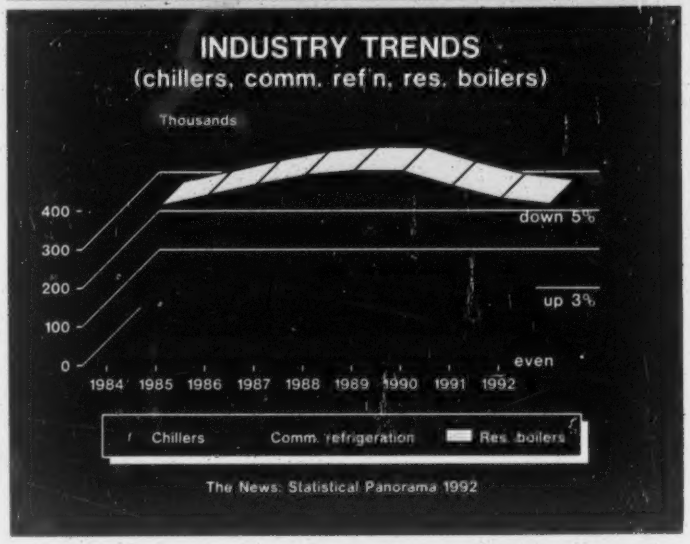
Commercial refrigeration: Despite a credit crunch and refinancing programs, the stiff competition faced by supermarkets from within and without should push this stable market up 3%, to 105,300 units,

Housing: After hitting bottom in 1991, the nation's housing market is headed for an 18% gain this year, to 1.2 million units. Most of the increase, buoyed by lower interest rates and better affordability, will be in single-family homes.

Replacements: Even though the overall growth curve for residential alteration, repairs, and replacements has flattened, the hvac replacement market has been expanding steadily. Utility incentives and a desire to improve efficiencies have been strong market drivers.


INDUSTRY TRENDS
(air conditioners, heat pumps, furnaces)

The News: Statistical Panorama 1992


INDUSTRY TRENDS
(chillers, comm. ref'n, res. boilers)

The News: Statistical Panorama 1992

Finding the details . . .

Air conditioners
  Auto . . . 8
  Capacity mix . . . 5
  Commercial . . . 4
  Efficiencies . . . 4, 26
  Evaporative condensers . . . 10
  Imports . . . 43
  Inventory . . . 4
  Penetration rates . . . 23, 27
  Replacements . . . 39
  Residential . . . 4
  Room units . . . 6
  Rooftops . . . 11
  Installed value . . . 6

Air handlers . . . 34

Boilers
  Commercial . . . 17
  Replacements . . . 40
  Residential . . . 16

Chillers . . . 6

Commercial markets
  Air conditioners . . . 27
  Boilers . . . 17
  Outlook . . . 28
  Replacements . . . 39
  Rooftops . . . 11
  Installed value . . . 5

Commercial refrigeration . . . 29

Cooling towers . . . 10

Dehumidifiers . . . 34

Electronic air cleaners . . . 34

Evaporative condensers . . . 10

Exports
  Key products . . . 43

Fancoil units . . . 10

Freezers . . . 33

Furnaces
  Efficiencies . . . 23
  Floor . . . 18
  Electric . . . 15
  Gas . . . 12
  Oil . . . 12
  Replacements . . . 39
  Solid fuel . . . 15
  Wall . . . 18

Heat pump
  Air-to-air . . . 4
  Commercial . . . 11
  Efficiencies . . . 4, 26
  Inventory . . . 4
  Penetration . . . 4, 22
  Replacements . . . 39
  Residential . . . 4
  Water heaters . . . 6
  Water-source . . . 5

Housing
  Characteristics . . . 29

Humidifiers . . . 33

Hydronic baseboard . . . 17

Ice makers . . . 33

Imports
  Key products . . . 43

Market share
  Unitary . . . 12

Oil
  Boilers . . . 16
  Burners . . . 18
  Efficiencies . . . 23
  Furnaces . . . 12
  Penetration . . . 22
  Replacements . . . 40

Ptac's . . . 5

Refrigerants . . . 36

Refrigerators . . . 33

Room heaters . . . 18

Rec. vehicle (RV) a/c . . . 30

Solar . . . 18

Shipments, 10 years . . . 30

Trade balance . . . 41

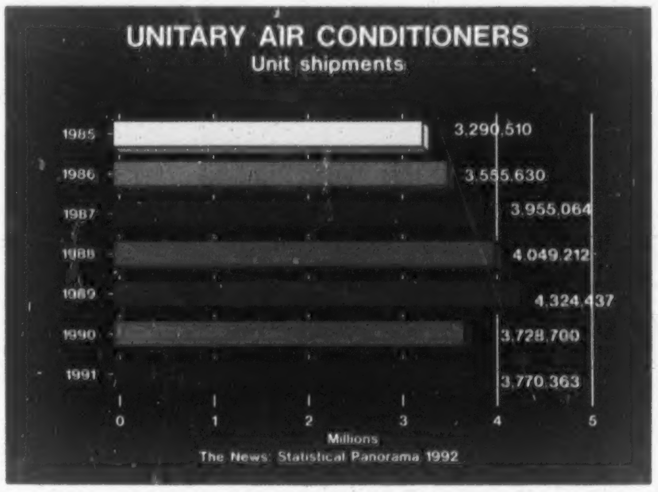
Unit heaters . . . 18

Unit coolers . . . 33

Wholesalers
  ARW outlook . . . 40
  NHAW outlook . . . 41

When public data were not available for products shipped, The News *relied on its sources to help provide estimates.*

AIR CONDITIONING

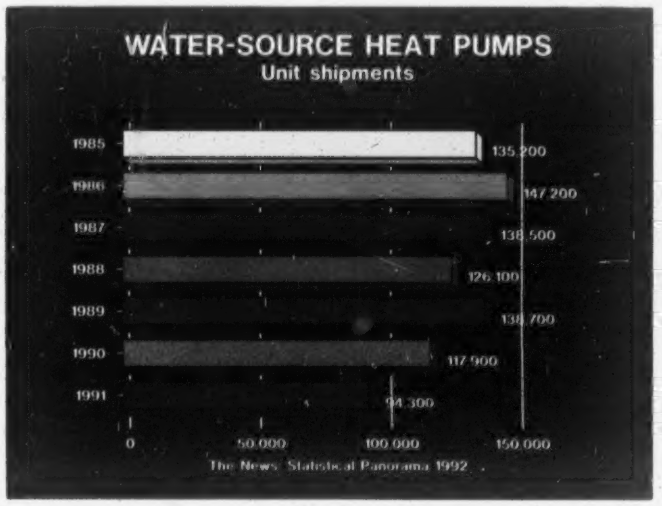


Despite a 15% slump in new home starts for the fifth year of decline in a row, an economy in recession for most of the year, low consumer confidence, and disruptions from the Gulf War and banking reform, shipments of unitary air conditioners (including air-to-air heat pumps) managed a significant 1.1% increase in 1991, according to the Air-Conditioning and Refrigeration Institute (ARI).

Unitary air conditioner shipments last year totaled 3,770,363 units, an increase of 1.1% over the 1990 total of 3,728,700 units. The record for unitary shipments was set in 1989 with a total of 4,324,437 units.

The strength of last year's market came primarily from the growing number of residential air conditioner replacements, which now account for more than six of 10 units sold in that market, and from early hot weather in key markets. They made up for new home construction losses and a downturn in light commercial activity.

Although there was a slight spurt in December, the anticipated inventory increase by those eager to beat the federal mandatory efficiency minimums didn't happen.



In fact, inventories were down by 10% at year's end and the inventory-to-shipment ratio was well within past norms. Distributor inventories, however, remain relatively high.

The mandatory minimum of 10 SEER (seasonal energy efficiency ratio) for both central residential air conditioners and heat pumps imposed Jan. 1 are not expected to cause any market disruptions because of "sticker shock" or equipment availability. The sales-weighted average of equipment shipped last year was within a few tenths of the minimum required of units manufactured after Jan. 1.

Looking ahead, the expected increase in new home starts, small gains in consumer confidence and in economic growth, and continued replacement strength should lead to a 1992 shipment total of 3,960,000 units.

That's a 5% improvement over last year's performance. It takes into account another relatively poor year for commercial products and a lesser increase for heat pumps. It also assumes no impact from artificial economic stimuli in an election year and a normal summer in key markets.

An unknown is whether contractors and manufacturers can maintain the higher profit margins associated in the past with high-efficiency equipment. Many fear that both may forsake hard-won profitability gains and treat units in the 10-SEER range as commodities.

These figures do not include air conditioning units and heat pumps shipped to foreign markets. Exports of U.S. unitary air conditioners in 1991 totaled 152,500 units, down 18.7% from the year-previous total of 187,600 units. Shipments to the Middle East, a prime market for these products, last year were directly affected by the war with Iraq. Unitary exports in 1989 totaled 310,205 units.

It should be remembered also that these figures include only those units shipped directly to foreign destinations by original equipment manufacturers (oem's). They include few, if any, units shipped by distributors and contractors.

Of the 3,770,363 unitary air conditioners shipped in 1991, ARI estimates that 88% — or 3,317,919 units — were for residential applications and 12% — or 452,444 units — were for commercial applications.

That ratio has changed from the 83%-17% split used from 1985 through 1988 and the 78%-22% split that held sway during the 1970s and early 1980s. The push of residential replacements keeps pushing down the commercial share by sheer weight of numbers.

Today's residential-commercial split is much different from that posted in 1952, the first year when these data were available, when 66.9% of unitary shipments went into commercial applications.

The unitary category includes electric air conditioners, gas air conditioners, air-to-air heat pumps, and rooftop equipment. It does not include packaged terminal air conditioners (ptac's), packaged terminal heat pumps (pthp's), room air conditioners and heat pumps, heat pump water heaters (air-to-water heat pumps), or water-source heat pumps.

Inventories down

The inventory of unitary air conditioners at the end of 1991 totaled 1,058,000 units, down 10.3% from the 1,179,000 units in inventory at the end of 1990. As a percentage of shipments, the 28% in 1991 was below the 30%-33% range that has been normal for much of the industry's history.

Of the total inventory at the end of 1991, some 279,000 units — or 26.4% of the total — were at the factory and 779,000 units — or 73.6% — were at the distributor level. Even though distributor inventories dropped by 7,000 units last year, the field inventory share increased from 66.7% a year earlier.

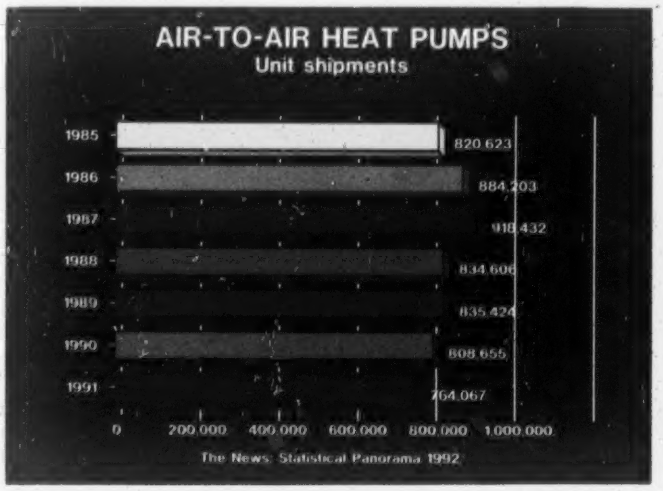
It's a far cry from the 49%-51% split in favor of distributors that held sway for many years. The shift of inventory to the distributor has been growing steadily for a decade and is almost the same for both cooling-only and heat pump equipment.

Field heat pump inventories ease back a bit

Perhaps it's time we accepted the new face of heat pumps in today's market. Although still mostly applied in the South, the heat pump's role as primarily a new construction product has been shifting as replacements grow for the 6.8 million units in existing U.S. homes.

Shipments of air-to-air heat pumps in 1991 totaled 764,067 units, a decline of 5.5% from the previous year's total of 808,655 units, according to ARI.

The shipment decline since the 1987 record year of 918,432 units has been about 154,000 units. Yet, if we look at the drop in housing starts in the South — 219,000 since 1987 — and the declines in both starts and heat pump penetration rates in the other regions, the losses for heat pumps should have been much greater. The difference has been a growing replacement market.



Although overall heat pump inventories have been brought into line in the past year, there is still serious concern about high field inventories. At the end of 1991, the total inventory of heat pumps stood at 257,800 units, or 33.7% of shipments. At the end of 1990, the total inventory was 301,000 units, or a too-high 37.2% of shipments.

Factory inventories at the end of 1991 stood at 62,300 units, down 14.4% from the total at the end of 1990 of 91,000 units, and representing only 24.2% of the 1991 total. Distributor inventories at the end of 1991, on the other hand, stood at 195,500 units.

Even though this represented a 6.9% decline from the end-of-1990 total of 210,000 inventoried heat pumps, the share of the total inventory increased from 69.8% to 75.8% at the end on 1991. This is more than double the historic range of supplies in the pipeline.

For contractors, this imbalance means better-than-normal availability of heat pumps from distributors and, quite possibly, better prices. For oem's and suppliers, it means smaller production orders as distributors work off their excess inventory.

Significantly, there will be a higher number of sub-minimum SEER heat pumps on this year's market than anticipated. Whether this bodes good or ill will depend on local markets.

Indications are that heat pumps, like their cooling-only counterparts, will have no difficulty in meeting the 1991 federal mandatory energy efficiency minimum of 10 SEER. In fact, the sales-weighted average SEER for heat pump shipments in 1991, at 9.77, marked the fourth year in a row that it bested the average for air conditioners (at 9.49 in 1991).

The slippage in the national penetration rates for heat pumps in new single-family homes from 30% in 1984 to 22.9% in 1990 is no cause for alarm. Penetration rates in the South — 43.2% for single-family and 49.6% for multi-family homes in 1990 — have remained fairly constant. As start rates in the South improve, so will heat pump shipments to that region.

Because of uncertainties in the economy and election-year economic tinkering, forecasting 1992

That's not all, folks

While this week's issue of Statistical Panorama contains a goldmine of valuable information, don't miss its continuation next week. Three main statistical categories will be highlighted in the April 4 issue:

Housing and construction — After braving its worst year since the end of World War II, the nation's housing industry is promising to pull the U.S. up from a lackluster end to the recession.

Labor — By all measures, 1991 was a poor year for the construction industry. This was reflected in a lighter-than-normal load of collective bargaining agreements.

Fuels and energy — U.S. energy consumption for the first 10 months of 1991 was 67.54 quadrillion Btu, an increase of 0.17% over the 67.427 quads consumed during the same period of 1990.

shipment totals is far from an exact science. The expected improvement in housing will be tempered by the overhang in field inventories, resulting in a 1992 heat pump shipment total of 787,000 units, an increase of 3%.

Capacity mix

An indication of capacity mix for 1991 unitary air conditioner shipments and how they compared with 1972's experience is shown in the table below:

	% 1972	% 1991
Under 1.8 ton	16	7.6
1.8 ton to 26,999 Btuh	23	20.0
2.25 ton to 32,999 Btuh	17	19.7
2.75 ton to 38,999 Btuh	22	23.1
3.25 ton to 43,999 Btuh	6	8.0
3.67 ton to 53,999 Btuh	7	9.0
4.5 ton to 64,999 Btuh	6	8.3
5.4 ton to 96,999 Btuh	1	1.6
8.1 ton and larger	1	2.6

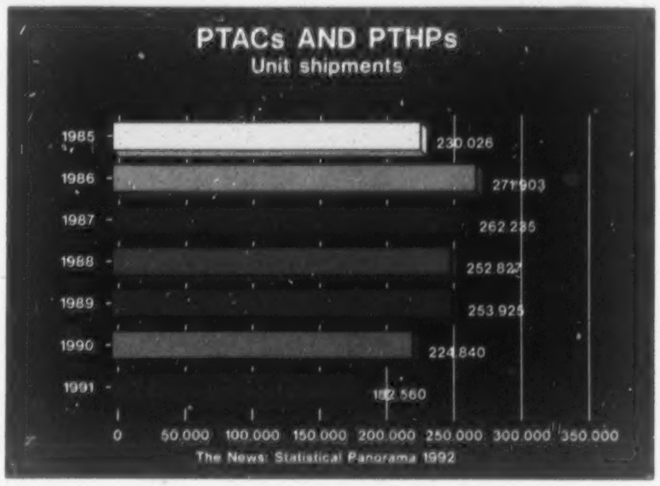
Installed value

The installed value of both unitary and field-engineered air conditioning systems put in place in 1990, the latest year for which these data are available, totaled $21.6 billion, down $400 million from the year-previous record total of $22 billion, according to ARI.

The $21.6 billion covers all comfort cooling systems, with the exception of room air conditioners, installed in the U.S. in 1990, reported David Martz, ARI director of statistics and business research.

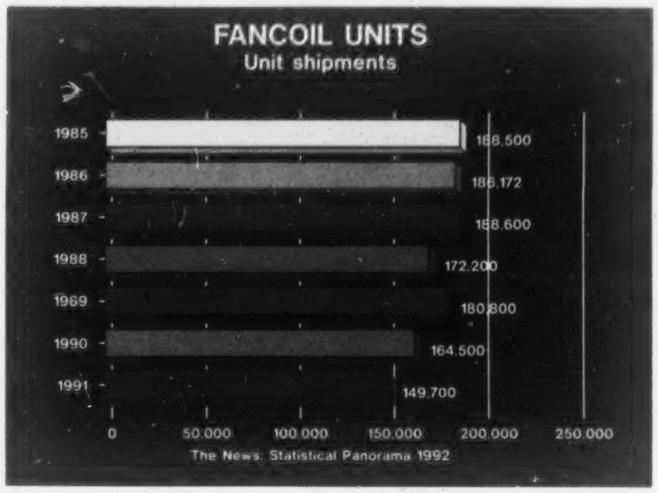
The relatively small change in overall value masks a significant reduction in unitary installed value that was partially offset by a surprisingly upbeat year for field-engineered systems.

The estimated installed value of field-engineered air conditioning equipment in 1990 amounted to $9.1 billion, an increase of 7% from the previous year's total of $8.5 billion. ARI reported that fewer chillers were shipped in 1990 than in 1989, but a greater proportion of larger units resulted in an increase in the overall value.



The estimated installed value of unitary equipment in 1990 totaled $12.5 billion, a 7% decline from the 1989 total of $13.5 billion. Residential unitary equipment accounted for $8.4 billion of the 1990 total, a drop of 12% from the 1989 record of $9.2 billion. Commercial unitary equipment was estimated at $4.1 billion, or 3% below the total for 1989.

The growth of the unitary air conditioning market over the past 30 years, particularly among central residential installations, has been steady. From an installed value of $464 million in 1956, the market grew to $1.3 billion in 1966, to $4.1 billion in 1976, to $9.7 billion in 1986, and $12.5 billion in 1990. It at least doubled in every decade.



The installed value covers the cost of unitary air conditioning as shipped from the factory together with labor, ductwork, registers and grilles, thermostatic and other controls, electrical wiring, and other components of the system installed by contractors.

In determining the installed value of field-engineered systems, ARI estimates that only 7.5% of the installed cost of the system is represented by the refrigerating machine. The remaining 92.5% represents air-handling equipment, duct, piping, valves, pumps, controls, labor, and all other installation costs.

For the record, the Bureau of the Census reported that 3,651,392 unitary air conditioners were shipped in 1990, the latest year for which these data are available. That represents a 16.9% decline from the 4,398,831 unitary air conditioners the Bureau said were shipped in 1989.

Ptac's

After holding steady through 1988 and 1989, the weakened commercial and institutional markets finally got through to packaged terminal air conditioners (ptac's) and packaged terminal heat pumps (pthp's). The drop in 1990 was 11.5% and, last year, that market recorded a larger drop of 18.8% to 149,700 units. The 1990 total was 164,500 units.

These products are used extensively in hotel, motel, nursing home, and suburban office park applications. Overbuilding in the hotel, motel, and office building markets has resulted in fewer market opportunities for these primarily new construction products.

The ptac portion, 56% of the total, declined by 17% from 123,380 units in 1990 to 102,400 units last year. The pthp portion, 44% of the total, declined by 21% from 101,460 units in 1990 to 80,160 units last year.

Ptac's compete head-on with commercial rooftop single-zone and variable air volume (vav) systems in the lower-tonnage ranges, and with field-engineered systems in office buildings and hospitals.

The Bureau of the Census reported that 107,664 packaged terminal units were shipped in 1990, the latest year for which these data are available. That represents an 18.7% decline from the 132,382 units the Bureau said were shipped in the previous year.

Taken separately, the Bureau reported that ptac shipments in 1990 totaled 64,709 units, down 21.4% from the 1989 total of 82,306 units. It said pthp shipments, at 42,955 units in 1990, were down 14.2% from the year-previous total of 50,076 units.

Water-source heat pumps

Shipments of water-source heat pumps, which comprise two distinct systems, totaled 94,300 units in 1991, down 20% from the 117,900 water-source units shipped in the previous year.

The older market segment, where we believe most of the decline took place, uses closed loops tied to a small boiler and cooling tower or evaporative condenser to maintain a loop water temperature between 60° and 90°F. They take advantage of load diversity and usually are applied in high-rise apartments, condominiums, and small- or medium-sized office buildings.

The other group, applied in single-family homes and a small but growing number of commer-

(Next Page, Please)

March 30, 1992
Vol. 185, No. 13, Serial No. 3286

The Air Conditioning, Heating and Refrigeration
NEWS

Air Conditioning, Heating & Refrigeration News (ISSN 0002-2276) is published 52 times a year by Business News Publishing Co., P.O. Box 2600 (755 W. Big Beaver Rd., 48084), Troy, Mich. 48007. Telephone 313-362-3700, FAX 313-362-0317.

Subscription Rate: $63 per year in the U.S. (in California, please add 7.75% sales tax); $87.41 per year in Canada (includes postage and $4.41 GST); $143 per year all other countries, payable in U.S. funds.

Microfilms of The News are available from: University Microfilms, 300 N. Zeeb Rd., Ann Arbor, Mich. 48103.

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Second Class Postage Paid at Troy, Mich. and at additional mailing offices.

POSTMASTER: Send address changes to Business News Publishing Co., P.O. Box 2600, Troy, Mich. 48007.

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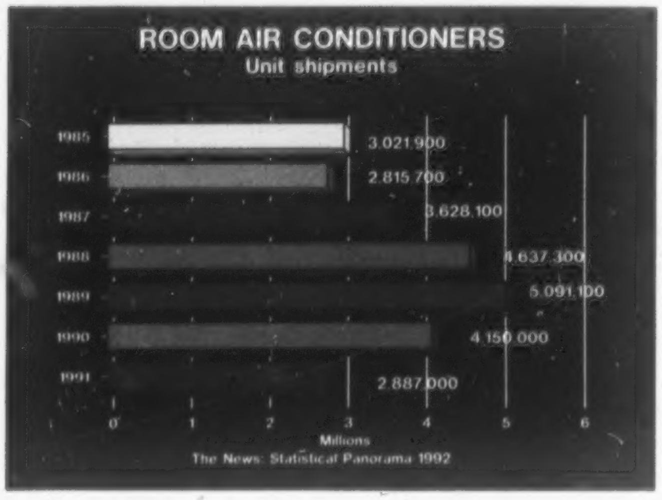

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cial office buildings, initially used water from a pond, a well, or the ocean at temperatures as low as 45°, and were usually confined to rural or exurban areas.

In recent years, however, the market has swung sharply to closed vertical or horizontal underground water-glycol loops to provide comfort heating and cooling at high efficiencies. One unit introduced in 1992 boasts an SEER of 20.

Most are water-to-air systems, although a few are water-to-water designs. They don't have to depend on the quantity or quality of the groundwater and can eliminate backup heat provisions when sized for the design heat load. Pumping costs are reduced, defrost cycles that degrade the efficiencies of air-to-air heat pumps are eliminated, and they can be applied on small lots in urban areas.

The News estimates that more than 20,000 residential and a few hundred commercial water-source heat pump systems were ground-coupled in 1991. Some of the manufacturers refer to them as geothermal heat pumps.

They have a comparatively high first cost and ground loops require specialized application knowledge. But substantial rebates (often $3,000 or more) from electric utilities in the Midwest and in Canada have encouraged installations in rather narrow geographic areas.

Heat pump water heaters

Domestic hot water in U.S. homes traditionally has been heated in natural gas-fired and electric resistance storage-type water heaters. A few are fired by LP or oil. Desuperheaters on air conditioners and heat pumps help in the South where running hours are long.

Medium-temperature solar heaters came and mostly went with federal and state subsidies. European instantaneous hot water heaters have had little impact. Some in the Northeast and parts of the Midwest still use water jackets on oil- and gas-fired boilers.

The air-to-water heat pump, with a first cost more than double that of electric water heaters, entered the market more than a decade ago with the promise of saving more than 40% on operating costs. But instead of capturing a big chunk of the 7.5 million annual water heater market, it all but disappeared. Today, the military is the biggest customer.

The primary reasons for the product's failure, we believe, were complexity, the uneasiness of hvac contractors with plumbing systems, and the plumber's uneasiness with the refrigeration cycle.

Integrated appliances

Although there are no figures for integrated appliances, there's little doubt that this niche appliance is gaining in popularity, especially in areas where the winter climate is not too severe. We believe it's being held back by the slowdown in housing starts.

These appliances use conventional gas-fired water heaters piped to a water coil in a separate air handler that often includes the evaporator of a split-system air conditioner. Electric water heaters don't have recovery rates fast enough for this system.

The water heater supplies both domestic hot water and hot water to the air handler for space heating. It saves by using (for space heating) much of what formerly were domestic hot water storage losses. Special fittings on the storage tank keep plumbers and hvac technicians from becoming involved in each other's trade.

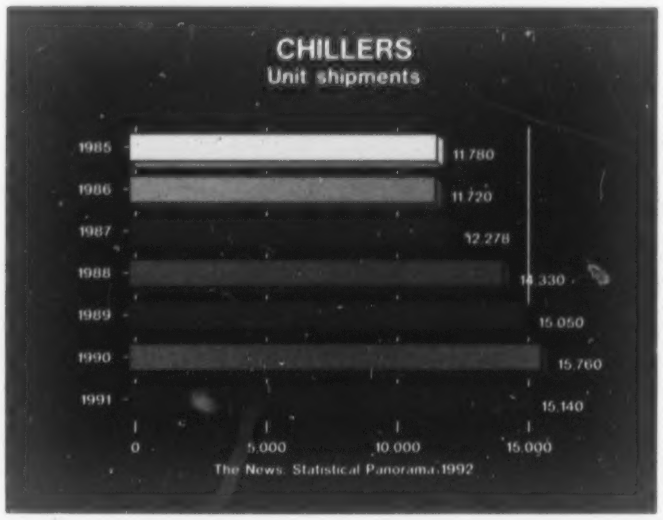
The system is being applied in both single- and multi-family housing units. It's being promoted by many gas utilities as a way back into the apartment and condominium markets, after they were virtually shut out by the early 1980's trend toward individual metering.

Hydronics manufacturers have offered an integrated boiler and domestic hot water system for many years. Air conditioning, if offered, often is in the form of a separate mini-split or ductless system. And a few oem's offer air conditioners and heat pumps with factory fitted desuperheaters for domestic hot water generation.

Room units await another hot spell

Room air conditioner shipments and nature's whims appear to go hand in hand. After surges in the years 1988 through 1990, triggered by two hot summers, room units slipped back to a more normal level last year.

Shipments of room air conditioners in 1991 totaled 2,807,000 units, a decline of 32.4% from the 1990 total of 4,150,000 units, according to the Association of Home Appliance Manufacturers (AHAM). The 1989 total, at 5,091,000 units, was the highest since the 1982 recession.



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Because room air conditioners are influenced heavily by impulse buying, forecasts are rarely reliable. It would appear that the replacement base for the 26.5 million homes equipped with one or more room units is slightly above 2 million units.

In August 1991, AHAM forecast that 1992 shipments would reach 3,402,000 units, a 21.2% increase over last year's performance. We believe shipments will increase by half that much to 3,100,000 but, with sustained hot spells in such key markets as the Northeast, we could both be too conservative.

We are reminded by AHAM that these shipment totals reflect units built in the U.S., exports, and those units imported from other countries. In recent years, more than one-third of all units sold were imports. Two major U.S. manufacturers moved all or most of their room unit production offshore several years ago.

For the record, the Bureau of the Census reported that 3,454,344 room units were shipped in 1990, the latest year for which these data are available. That reflected a 10.8% decline from the 3,872,564 room units the Bureau said were shipped in 1989.

Chillers

Hampered by an overbuilt office building market, chiller manufacturers have maintained a relatively high shipment level with exports, domestic replacements, and a stable industrial refrigeration market. Last year was no exception.

Total shipments of chillers in 1991 amounted to 15,140 units, down 3.9% from the year-previous total of 15,760 units. The decline was modest when shipments in the 11,000 range during most of the 1980s is considered.

After substantial increases in 1988 through 1990, shipments of centrifugal and screw compressors declined by 10% in 1991 to 4,500 units. The 1990 total was 5,000 units. In both of the last two years, more than one-third of the total was represented by exports. We have not been able to determine what proportion of the category is screw compressors.

Reciprocating chillers shipped in 1991 totaled 10,450 units, a decline of 1.4% from the year-previous total of 10,600 units. Again, exports are believed to represent about a third of last year's shipments.

The market for absorption chillers, at 190 units last year, increased by 18.7% from a 1990 total of 160 units. These indirect-fired (hot water and steam) machines are supplemented in the U.S. market by imported direct-fired absorption chillers, mostly from Japan.

In December 1991, dollar bookings for large-tonnage liquid chillers were down 21% from December 1990, and the year-end total was down 8%. On the other hand, dollar bookings in December, 1991 for reciprocating liquid chillers were up by 21% over the same time a year earlier, and the year-end total was up 9%.

(Page 8, Please)

Year	Recip.	Cent.	Abs.
1970	10,300	4,150	1,000
1971	10,000	4,000	900
1972	10,000	3,000	900
1973	10,400	4,100	800
1974	11,000	4,500	1,000
1975	8,250	4,950	700
1976	7,600	3,400	500
1977	8,900	3,000	450
1978	8,100	3,350	370
1979	8,100	3,350	280
1980	9,650	4,600	280
1981	9,250	4,300	240
1982	8,500	3,600	200
1983	7,500	3,100	140
1984	8,100	2,950	160
1985	8,160	3,490	130
1986	7,800	3,700	160
1987	8,440	3,700	130
1988	9,800	4,400	130
1989	9,800	4,990	180
1990	10,600	5,000	160
1991	10,450	4,500	190

The Air Conditioning, Heating and Refrigeration
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(Continued from Page 6)

The question of alternative refrigerants to replace the CFC (chlorofluorocarbon) refrigerants used in most liquid chillers has been largely resolved, at least for the short term. Other questions, such as recovery and recycling, venting elimination, and toxicity, remain.

The alternates — HFC-134a in place of CFC-12, HCFC-123 in place of CFC-11, and HCFC-22 — have been developed to replace CFCs that are being both restricted and taxed. Production of CFCs, limited to 80% of 1986 levels this year and taxed at a rate of $1.67/lb, originally was scheduled to end at the turn of the century. In recent weeks, however, President Bush has suggested a 1995 termination date, a move supported by most industry groups in the U.S. and abroad.

Industry groups, while supporting an earlier CFC ban, are fighting to maintain the 2020 (use in new equipment) and 2030 (production ban) now in place in the U.S. ARI has put together an industry consortium to search for a suitable replacement for HCFC-22.

And, amidst confusion generated by intramural competition among manufacturers, the industry awaits final toxicity and mechanical room regulations covering HCFC-123. Meanwhile, refrigerant producers continue to develop blends that could mean better long-term alternatives.

The question of alternative refrigerants to replace the CFC (chlorofluorocarbon) refrigerants used in most liquid chillers has been largely resolved, at least for the short term.

Also in the wings are belated Environmental Protection Agency (EPA) regulations covering venting (scheduled to end as early as July 1), recovery, the possible certification of contractors qualified to handle recovery and recycling, and the qualification of reclamation facilities.

For the record, the Bureau of the Census reported that 1,555 centrifugal chillers were shipped in 1990, the latest year for which these data are available. That represents a decline of 6.7% from the 1989 total of 1,667 centrifugal chillers. These totals do not include centrifugals with capacities of less than 200 tons or more than 400 tons.

The Bureau reported that 16,775 reciprocating chillers were shipped in 1990, down 1.8% from the previous year's total of 17,082 reciprocating chillers. Shipments of absorption systems in 1990 totaled 1,486 units, down 11.2% from the 1989 total of 1,673 units.

Because room air conditioners are influenced heavily by impulse buying, forecasts are rarely reliable. It would appear that the replacement base for the 26.5 million homes equipped with one or more room units is slightly above 2 million units.

Auto a/c option steady at 92%

According to *Ward's Automotive Reports*, there were 5,992,308 air conditioning units installed on U.S. domestic automobiles in the 1991 model year, down 5.8% from the 6,361,631 factory air installations made in the 1990 model year.

However, U.S. domestic auto production in the 1991 model year totaled only 6,528,224 units, down 5.7% from the previous year's total of 6,925,229 units. This means that, in the 1991 model year, factory air penetration stood at 91.8%, virtually equal to the 91.9% penetration rate for the 1990 model year.

Of the cars made in the U.S., almost all luxury and full-size models feature air conditioning as standard equipment. Some compact and subcompact models, particularly those sold in northern states, are ordered without air conditioning. Dealers also order a few in standard floor plans in order to advertise lower prices.

Total light truck production in the 1991 model year totaled 3,793,863 units, down 10.7% from the year-previous total of 4,247,123 units. The penetration

(Page 10, Please)

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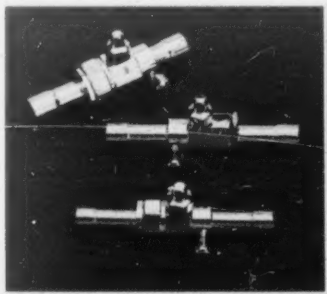

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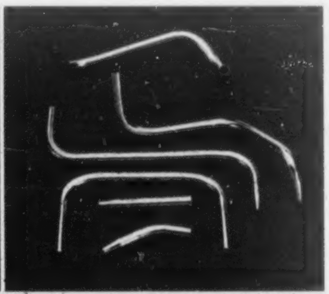

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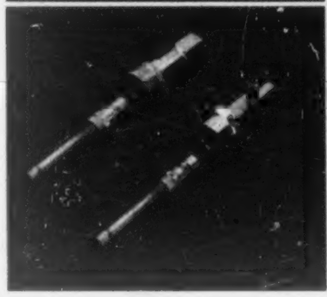

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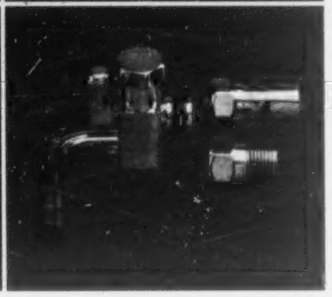

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KA27

AIR CONDITIONING

(Continued from Page 8)

of air conditioning in the light truck market in the 1991 model year, at 81.9%, increased slightly over that for 1990 even though production (3,454,088 units in 1990, and 3,108,566 units in 1991) was down by 10%.

It should be noted that most U.S. cars produced for the 1993 model year will be equipped with air conditioning systems using HFC-134a refrigerant instead of CFC-12. The infrastructure that includes the certification of recovery equipment, methods, and service technicians is already largely in place.

For the record, the Bureau of the Census reported that 9,064,771 auto air conditioning systems were shipped in 1990, the latest year for which these data are available. That represents a 2.7% decline from the 9,323,258 systems the Bureau said were shipped in the previous year.

The Bureau reported that an additional 4,497,727 air conditioning systems for trucks, buses, and off-road vehicles were shipped in 1990, down 6.6% from the 1989 total of 4,817,186 units. The 223,576 recreational vehicle air conditioners the Bureau said were shipped in 1990 represented an 8.4% decline from the 1989 total of 244,164 units.

The aftermarket

Although there are no hard figures, the International Mobile Air Conditioning Association (IMACA) estimates that the auto air conditioning aftermarket has stabilized at about 750,000 units annually. The agricultural and medium-truck markets have been strongest in recent years.

Evaporative condensers

Shipments of evaporative condensers in 1990, the latest year for which these data are available, totaled 2,265 units. That represents a 6.6% decline from the 2,424 evaporative condensers the Bureau said were shipped in 1989.

Fancoil units

Shipments of fancoil units in 1991 totaled 149,700 units, a decline of 9% from the year-previous total of 164,500 units. These figures do not include exports.

According to the Bureau of the Census, a total of 250,037 fancoil units were shipped in 1990, the latest year for which these data are available. That represents a 5.5% decline from the 1989 total of 264,474 units.

Of the units the Bureau said were shipped in 1990, 10.6% were vertical stack units, 45.6% were vertical units, and 43.8% were horizontal units.

Cooling towers

According to the Bureau of the Census, total shipments of cooling towers in 1990, the latest year for which these data are available, totaled 9,059 units. That represents a decline of 27.7% from the 1989 total of 12,529 units.

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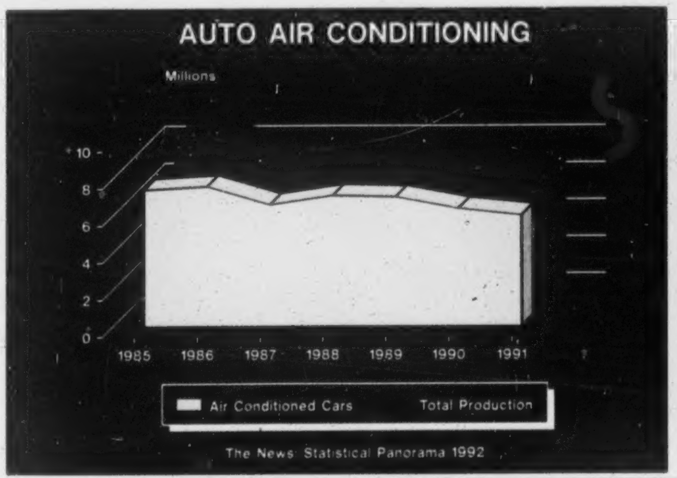

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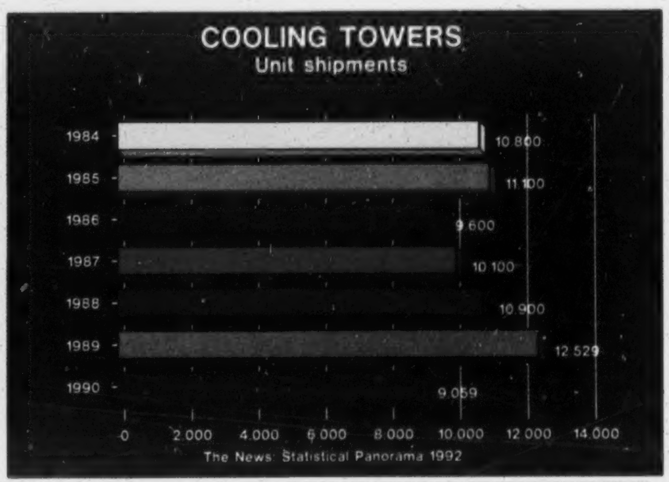

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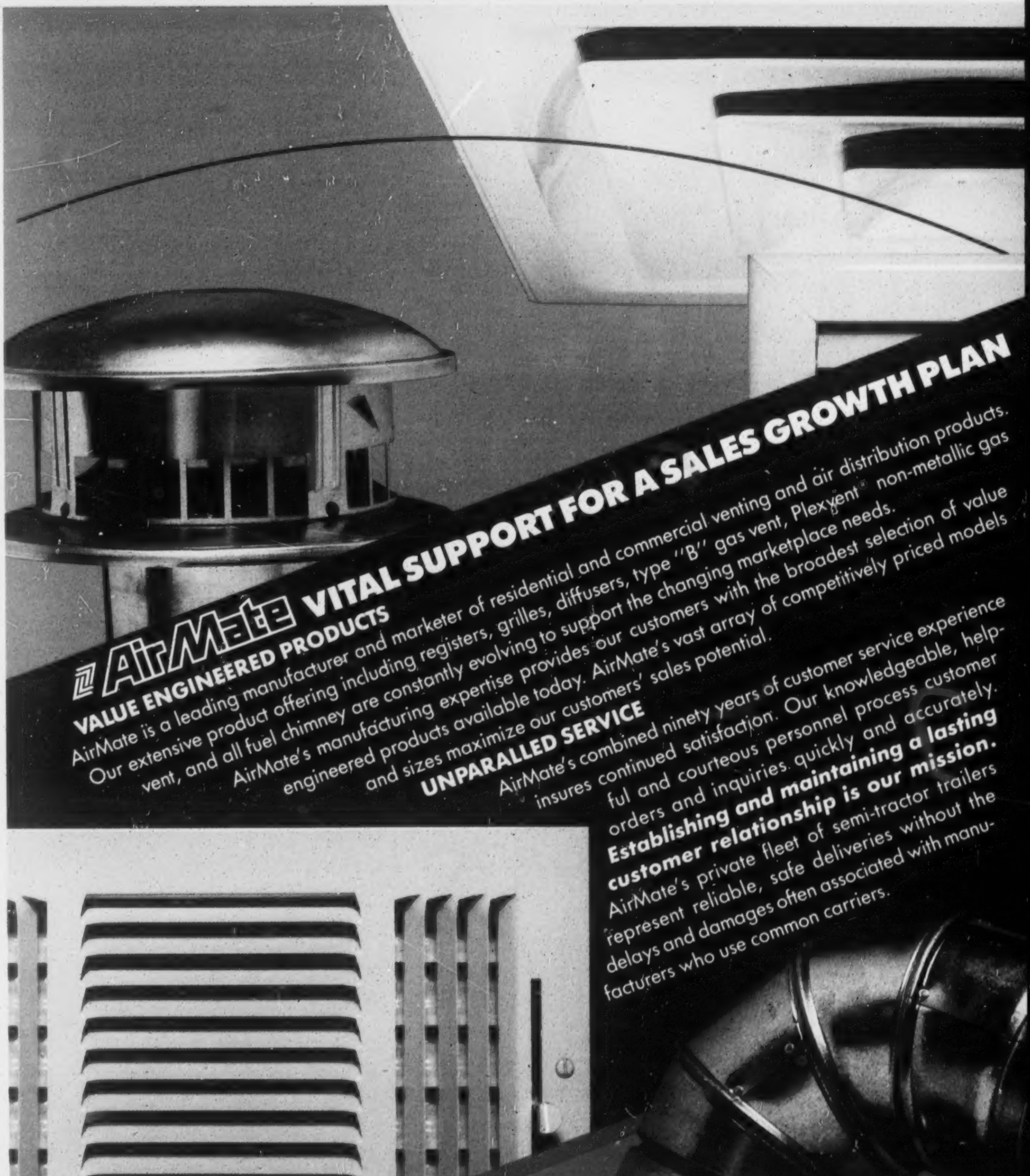
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AIR CONDITIONING

Even with a decline, rooftops outpace other commercial units

Pitted against a commercial new construction market where spending dropped by 26% last year, commercial rooftops did well to hold a decline of less than 10%.

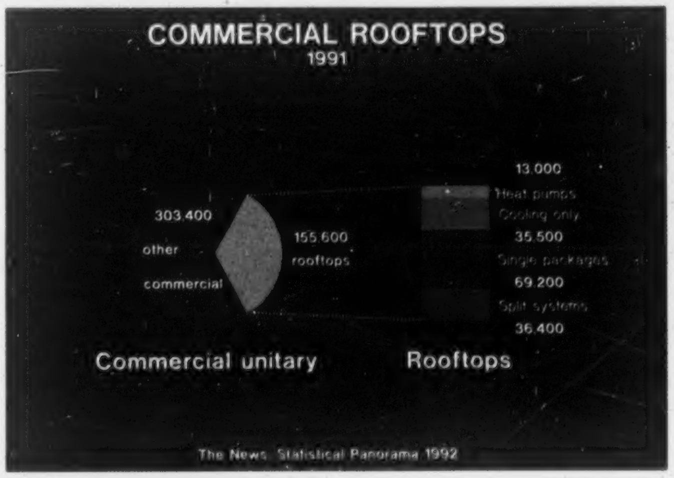
The strength of rooftops came primarily from replacements, a factor that was not so evident among smaller commercial units.

According to our calculations, commercial rooftop shipments in 1991 totaled 155,600 units, a decline of 9.7% from the 172,350 rooftops *The News* estimated were shipped in 1990. At the same time, the total commercial unitary market dropped by 17.9% from 559,300 units in 1990, to 459,000 units last year.

Shopping center and other light commercial construction tends to follow closely behind the housing market, which has been slumping since 1986. However, the losses in light commercial construction spawned by housing have been largely made up by the increase in replacements.

Not only are the rooftop units installed in the 1960s and 1970s inefficient by today's standards, many of them are just plain worn out. New designs include multiple compressors — many of them scrolls — for better load matching, and effective economizer cycles.

Rising utility bills have provided owners with incentives to replace old inefficient units.



The News Statistical Panorama 1992

Commercial rooftop units really represent a market application of several different products, rather than a specific product type that can be easily tracked statistically.

For example, all-year units, identified by both ARI and the Bureau of the Census, clearly imply a heating capability. However, both single-package and split-system rooftop units — though they may have been shipped (and counted) as cooling-only units — may have modular heating sections added in the field.

Heat pumps imply one, and usually two, methods of heating in addition to their cooling capabilities. Another complicating factor is that small, all-year rooftops are applied in more residential than commercial situations.

The News bases its assessment of the commercial rooftop market on the known number of unitary shipments in 1990 and 1991 of 5.4 tons or more; by past ARI and Bureau of the Census ratios of system types and sizes; and by the residential-commercial unitary split.

Although not as up-to-date as we would like, the exercise does produce a breakdown within a few percentage points of the latest (1991) ARI report of equipment sizes.

We have arbitrarily selected 5.4 tons as the starting point for commercial rooftops. We readily admit, however, that there are many commercial units smaller than that, just as there are residential units larger than 5.4 tons. But the line had to be drawn somewhere.

By applying the known — and latest — Bureau of the Census ratios to 1990 and 1991 ARI shipment figures, we find there were 459,000 commercial units shipped in 1991, a decline of 17.9% from the 559,300 units ARI indicated were shipped in 1990.

By applying the ratios evident in the 1990 Bureau of the Census report, we also found that, in 1991:

- 102,050 were split systems, of which 36,400 were rooftop units with capacities of more than 5.4 tons. The respective 1990 totals were 123,900 and 40,600.
- 179,200 were all-year single packages, of which 69,200 were rooftop units with capacities of more than 5.4 tons. The respective 1990 totals were 217,600 and 76,900.
- 79,200 were cooling-only air conditioners, of which 35,500 were rooftop units with capacities of more than 5.4 tons. The respective 1990 totals were 96,200 and 39,500.
- 1,500 were multi-zone rooftops,

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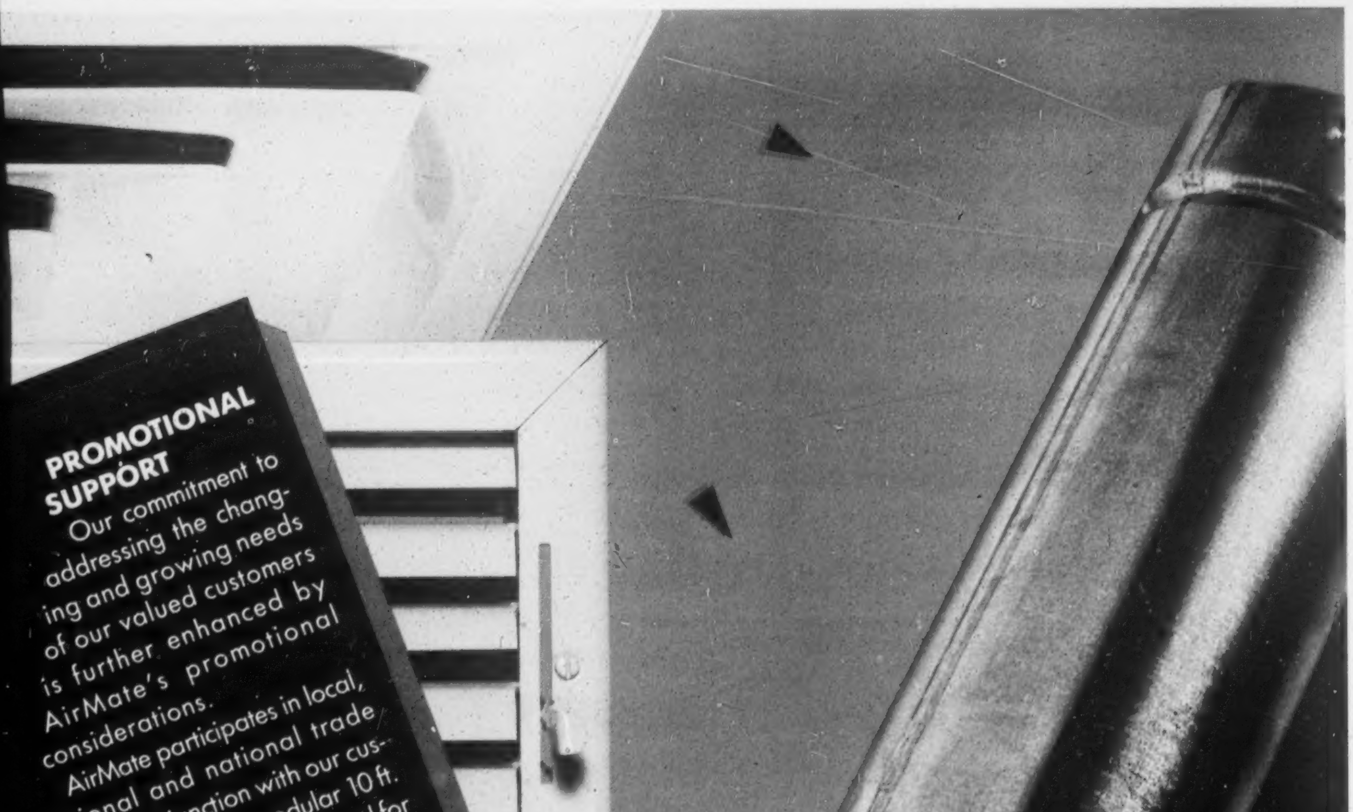
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HEATING

Despite another comparatively mild winter in major markets and yet another 15% drop in housing starts, gas furnace shipments climbed back to the 2 million mark enjoyed in all but one year since 1986. An almost 10% decline in 1990 dropped gas furnaces below the 2 million plateau and away from the previous year's record.

Shipments of gas furnaces in 1991 totaled 2,056,670 units, an increase of 5.4% over the 1990 total of 1,950,465 gas furnaces, according to the Gas Appliance Manufacturers Association (GAMA). In the years 1986 through 1989, shipments exceeded 2 million — including the record of 2,162,185 units in 1989. The next 2 million year before that was in 1972.

The acknowledged strength of the replacement market among more than 40 million homes equipped with gas furnaces, and the newer upgrade market, is demonstrated by the fact that gas furnaces have sustained high shipment levels over the past six years, despite five years of relatively mild winters in prime markets and a 43.8% decline in housing starts.

Another positive factor has been that home starts in the gas furnace's prime Midwest market have dropped by only 20% since 1986, while declines in the other regions amounted to 43.5% in the South and 61.5% in the Northeast.

An unknown factor that affected 1991 gas furnace shipments — and will have a similar affect on shipments this year — is how many manufacturers over-produced furnaces with AFUEs (annual fuel utilization efficiencies) of less than 78% in order to beat the federal mandatory minimum efficiency rules that took effect on Jan. 1.

Although manufacturers could not produce furnaces with AFUEs below 78% after Jan. 1, furnaces built before that date may still be sold. This produces an abnormality in the marketplace that will not be fully resolved until the 1993 figures are known.

Because only 42% of the units shipped in 1990 had efficiencies at or above today's mandatory minimums, we believe that as many as 150,000 gas furnaces with AFUEs below 78% — and above 1991 market requirements — were shipped last year. This means that 1991 shipments were artificially stimulated above the 2 million mark, and that this year's totals will suffer as the below-minimum units are assimilated into the market.

It appears there will be no difficulties among manufacturers in meeting the new efficiency minimums. For most, it will only mean dropping virtually all of their atmospheric furnace lines. Intermittent ignition devices will be

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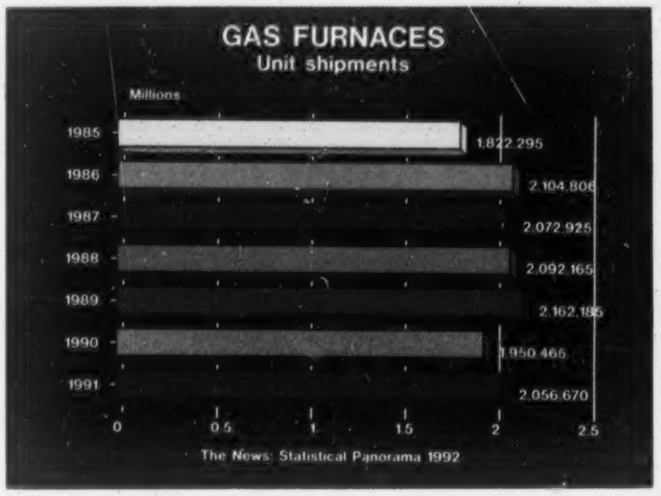

The News: Statistical Panorama 1992

AIR CONDITIONING

(Continued from Preceding Page)

all of which had capacities of more than 5.4 tons. This category has grown from a base of about 300 units for many years because of replacement activity.

- 97,050 were heat pumps, of which 13,000 had capacities of more than 5.4 tons. The respective 1990 totals were 121,300 and 14,850.

Taken together, there were 155,600 commercial rooftop units with capacities in excess of 5.4 tons shipped in 1991. That leaves 303,400 commercial units with capacities of less than 5.4 tons.

A breakdown of these units within a segment so heavily dominated by residential equipment is beyond our abilities.

Our unofficial estimates of unitary market shares

When it comes to determining shares of the U.S. unitary air conditioning market held by individual manufacturers, we must depend on "feel" rather than reliable numbers.

There are no reliable numbers.

Each year the percentages shift as companies enter or leave the market, as one company is acquired by another, or as distribution and product improvements are reflected in the marketplace.

Each year, for example, *The News* reports many mergers, acquisitions, or spin-offs involving companies in the hvacr industry.

It should be remembered that, like all national totals, our estimates of market share seldom will provide an accurate picture of what's happening in any specific city or area of the country.

Some essentially regional manufacturers, with a small national market share, often are among the leaders in the areas where their distribution is concentrated. There also are strong brand loyalties, a prime reason the larger manufacturers keep brand names alive when they make acquisitions.

Another distortion comes from the interest of individual contractors.

Whether a particular manufacturer is strong in new construction, add-on, or replacement sales makes little difference to many. But, for contractors that specialize, the list of competitive brands can expand or contract according to that specialty. It also can change when the contractor's interests change.

Because of these and other situations within their own cities, contractors often get a distorted view of national market shares. For them, and for market researchers not deeply involved in this industry, *The News* offers these educated guesses of unitary equipment market shares in terms of total units shipped:

- Carrier (including Bryant, Day & Night, and Payne) — 21%.
- Inter-City Products (Heil, Tempstar, Arcoaige, and Comfortmaker. Does not include KeepRite, ICP's Canadian operation.) — 15%.
- Rheem (including Ruud and WeatherKing) — 14%.
- Lennox (including Armstrong, Johnson, and Air Ease) — 13%.
- Trane — 11%.
- Goodman (Janitrol) — 10%.
- Central Environmental Systems, York International Corp. — 8%.
- All others — 8%.

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(Continued from Page 12)

used on at least 65% of furnaces shipped in 1992, according to Honeywell, up from 59% in 1991.

The substantial increase in cost for furnaces with AFUEs of 78% or more may come down somewhat because of economies of scale. But contractors will find some resistance in the marketplace to the increased prices. How much that will count remains to be seen.

An average of November, 1991, GAMA member forecasts indicated that 1992 shipments of gas furnaces would total 2,023,300 units, or almost even with last year's performance. Given the slight increase in new home starts, continued strength in replacements, and the negative impact of sub-minimum units, that appears to be about right.

Looking ahead, GAMA's members see a gradual improvement in gas furnace shipments over the next five years to an average of 2,244,400 units in 1995. Optimists among them see the 1995 total at 2.4 million units while the pessimists are forecasting only 2,060,000 units in 1995.

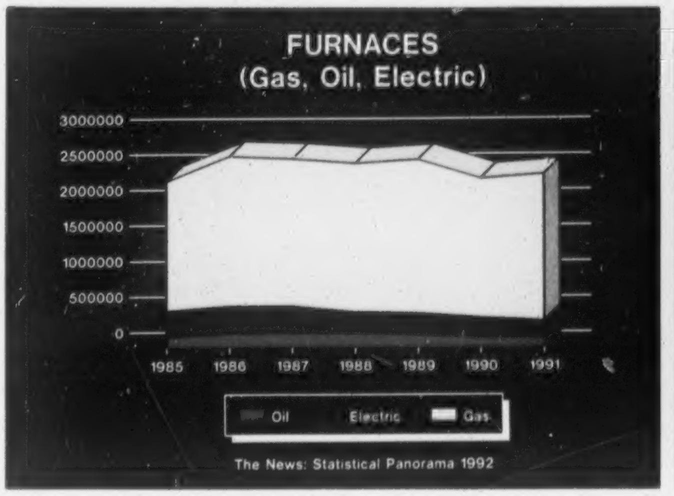
In recent years, contractors have earned increased profit margins from the installation of high-efficiency furnaces. This may still hold true for condensing furnaces with efficiencies above 90%. The prime question is whether they have the collective discipline to hold these increased profit margins for furnaces in the 78% through 85% efficiency range.

For the record, the Bureau of the Census reported that 2,008,243 gas furnaces were shipped in 1990, the latest year for which these data are available. That represents an 11.2% decline from the 1989 total of 2,261,959 units.

Here and elsewhere in this issue, we'll report Bureau of the Census figures where they are available, even though they often vary considerably from industry figures. We favor the industry figures because they are more up-to-date and, in our opinion, are developed by people in closer touch with the market.

Many of the heating equipment figures are not available from the Bureau of the Census this year. It discontinued the annual MA-34N Current Industrial Report covering much heating equipment with the 1989 report and, in future, will only include these figures in the once-in-five years Census of Manufactures being conducted this year and not available until late 1993 or early 1994.

Non-electric warm air furnace reports are included in the MA-35M Current Industrial Report, Refrigeration, Air Conditioning, and Warm Air Heating Equipment.



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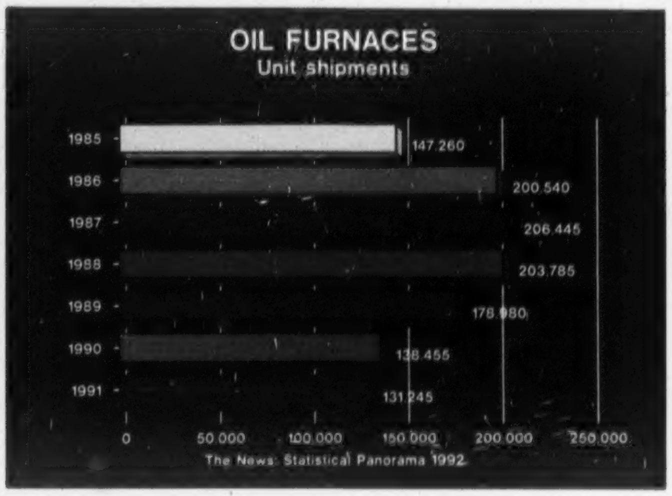

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Oil furnaces fall victim to NE decline

The fortunes of the oil furnace industry appear to mirror those of the home market in the Northeast. After three bumper years in the middle-to-late 1980s, oil furnace shipments have fallen for three years in a row.

Shipments of oil furnaces last year totaled 131,245 units, a 5.2% decline from the previous year's total of 138,455 units, according to GAMA. The drop reflects only in part the precipitous decline in new home starts in the Northeast.

Replacements have been a major factor in the oil heat market for many years. The strength of this market, together with the relative strength of housing starts in its secondary Midwest market, have

Each *Statistical Panorama* includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.

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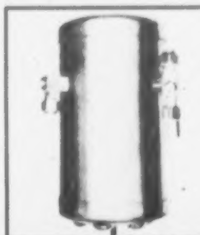

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helped to keep the decline in oil furnace shipments to almost half of the decline in the Northeast housing market. Too, after a price spike early in the Gulf War days, fuel oil prices have declined.

Oil furnaces should have no difficulty meeting the 1992 federal efficiency minimums. More than two-thirds of the oil furnaces shipped during the past three years have had AFUEs of 80% or more. And virtually all replacement burners fitted to older furnaces are retention-head or other high-efficiency types.

An average of GAMA's member forecasts puts 1992 oil furnace shipments at 126,300 units, a 3.8% decline from last year's performance. We can't agree. Even though new home starts in the Northeast probably will not keep pace with the rest of the nation, we believe the strength of the replacement and upgrade markets will hold oil furnace shipments even at 131,200 units.

Looking to the future, GAMA's members see a gradual improvement in the oil furnace markets to 137,500 units in 1995. Optimists see as many as 167,500 units in 1995 while the pessimists are forecasting 121,000 units.

For the record, the Bureau of the Census reported that 127,082 oil furnaces were shipped in 1990, the latest year for which these data are available. That represented a 23.8% decline from the total of 166,845 oil-fired furnaces shipped in the previous year.

Electric furnaces slip another 12.4%

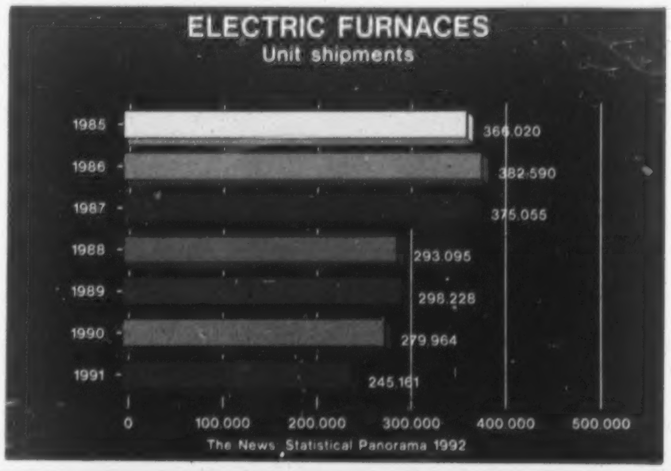
Shipments of electric furnaces in 1991 almost were in lock-step with the further decline of new home starts in the South, the prime market for this new construction-oriented product.

Total shipments last year, at 245,161 units, were down 12.4% from the 1990 total of 279,964 units, according to GAMA. (New home starts in the South declined by 13.6% last year.)

The primary role of the electric furnace has been to serve as a backup heat source for air-to-air heat pumps, and as a sole heat source for homes in relatively mild climates. Unlike its gas- and oil-fired cousins, it enjoys a small replacement market.

Its principal market is in the South. In fact, the more than 100,000-unit drop in electric furnace shipments since 1986 has closely followed the decline in housing starts in that region.

An average of GAMA members forecast in November that 1992 shipments of electric furnaces would total 305,700 units, a 24.7% increase. We believe the forecast is much too optimistic. The increase probably will be more like 5%, or 257,500 units. An average of GAMA's members forecast shipments of 350,000 electric furnaces in 1995, with optimists at 400,000 units and pessimists at 300,000 units.



The News Statistical Panorama 1992

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All furnaces

Total shipments of **gas, oil, and electric furnaces** in 1991 amounted to 2,433,076 units, an increase of 2.7% over the 1991 total of 2,368,884 units. A record 2,687,935 units were shipped in 1986.

It's interesting to note that, in 1972 when the previous combined shipment record was set, new homes led the applications parade with new home starts topping the 2 million mark. In more recent times, replacements and upgrades are leading the applications parade as new home starts slip to half of the 1972 values.

Looking ahead, we expect the total for gas, oil, and electric furnaces to be in the neighborhood of 2,412,000 units, or about 1% less than last year. It would have been a bit more, but for the artificial boost in gas furnace shipments late last year, which will have to be assimilated in 1992.

The Bureau of the Census reported that 1,823 **solid-fuel (coal, coke, and wood) furnaces** were shipped in 1990, the latest year for which these data are available. That represents a 9% increase over the 1,672 solid-fuel furnaces the Bureau said were shipped in 1989.

Similarly, the Bureau reported that 875 **gravity warm air furnaces (both cast iron and steel)**

(Next Page, Please)

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(Continued from Preceding Page)

furnaces were shipped in 1990, a decline of 15.1% from the 1,031 gravity furnaces the Bureau said were shipped in 1989.

Home boiler shipments down

With new home construction in its prime Northeast market falling about its ears, boiler replacements and upgrades in 1991 couldn't make up the difference. Hydronic systems, installed in nearly four of 10 new homes in the Northeast, have suffered through a 26.7% drop in new home starts in 1990 and another 14% decline last year.

Shipments of **cast iron and steel boilers** in 1991 totaled 296,234 units, a decline of 9.9% from the 1990 total of 328,737 units, according to The Hydronics Institute (HI). Unlike the 2.3% dip in 1990, which mostly was in steel boiler shipments, the decline last year was across the board.

The strength of the replacement and upgrade markets is demonstrated by the fact that, until last year, boiler shipments have managed a pair of small increases and a pair of slight drops since 1986, while new home starts in the Northeast have plummeted by 61.5% from 293,500 in 1986 to 112,900 last year.

Shipments of **cast iron boilers**, at 272,622 units in 1991, were down 9.9% from the total of 302,681 units in the previous year, according to HI. **Steel boiler** shipments, which totaled 23,612 units last year, were down 9.4% from the 1990 total of 26,056 units.

Gas-fired cast iron boilers continue to dominate the market, but it wasn't always so. Gas curtailments during the early and middle 1970s restricted the sale of gas boilers but, with the sudden availability of natural gas near the end of that decade, coupled with the second oil price shock, there was a surge in demand for gas-fired units.

The gas share of the cast iron boiler market peaked at 85% in 1980 from a low of 50% only three years earlier. In 1991 it was 64.7%, almost the same as in the previous year. Total shipments of gas-fired cast iron boilers in 1991 amounted to 176,433 units, down 9.7% from the 1990 total of 195,319 units.

Oil's share of the cast iron boiler market, which peaked at 49.5% in 1977 and dropped to only 15% three years later, was 35.3% in 1991, virtually the same as in the previous year. Total shipments of oil-fired cast iron boilers in 1991 amounted to 96,189 units, down 10.4% from the 1990 total of 107,362 units.

The share of cast iron hot water boilers, at 83% in 1991, was up a point from the 82% share a year earlier. Similarly, the 1991 share for steam boilers, also remained relatively constant at 18%. Shipments of cast iron hot water boilers, at 226,537 units in 1991, were down 8.7% from the year-previous total of 248,067 units. Steam boiler shipments, at 46,085 units last year, were down 15.6% from the 1990 total of 54,614 units.

In the case of **steel boilers**, oil increased its domination in 1991

1991 cast iron boiler shipments by fuel

Gross output, Btuh	Gas-fired	Oil-fired	Total
Less than 50,000	7,763	60	7,823
50,000 to 74,999	27,313	1,273	28,586
75,000 to 99,999	46,304	7,693	53,997
100,000 to 124,999	43,958	36,786	80,744
125,000 to 149,999	16,799	6,910	23,710
150,000 to 199,999	14,969	30,424	45,392
200,000 to 249,999	9,243	4,854	14,168
250,000 to 449,999	6,561	2,950	9,490
450,000 to 949,999	2,222	2,153	4,325
950,000 to 1,549,999	640	1,198	2,041
1,550,000 and over	661	1,888	2,549
Total	**176,433**	**96,189**	**272,622**

1991 cast iron boiler shipments by thermal capacity

Gross output, Btuh	Steam	Water	Total
Less than 50,000	1,529	6,294	7,823
50,000 to 74,999	1,059	27,527	28,586
75,000 to 99,999	6,864	47,133	53,997
100,000 to 124,999	11,520	69,224	80,744
125,000 to 149,999	5,617	18,093	23,710
150,000 to 199,999	8,193	37,199	45,392
200,000 to 249,999	4,193	9,975	14,168
250,000 to 449,999	2,987	6,503	9,490
450,000 to 949,999	1,847	2,478	4,325
950,000 to 1,549,999	919	919	1,838
1,550,000 and over	1,357	1,192	2,549
Total	**46,085**	**226,537**	**272,622**

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with a 91.5% share, up from 86.9% a year earlier. Gas-fired units in 1991, with only a 1.6% share, and bare (no burner) boilers, with a 6.8% share, both contributed to oil's gain.

In its five-year forecast, an average of GAMA members expect gas-fired boiler shipments to reach 155,300 units in 1995. Some optimists expect shipment totals of 243,000 in that year while the pessimists expect only 113,171 units. For oil boilers, the average is 86,900 units in 1995 while the extremes range from 113,000 to 63,800 units.

The 21,615 oil-fired steel boilers shipped in 1991 recorded only a 4.5% decline from the year-previous total of 22,645 units. The 381 gas-fired steel boilers shipped last year, however, recorded a 40.5% drop from the 640 units shipped in 1990. A similar 41.7% decline was recorded for bare units, from 2,771 units in 1990 to 1,616 units last year.

Radiation shipments in 1990, according to HI, were:

Convectors — 1,592,935 sq ft EDR (equivalent direct radiation) in 1991, down 7.6% from the 1,724,005 sq ft EDR shipped in the previous year.

Baseboard — 9,389,821 lineal ft last year, down 17.9% from the 1990 total of 11,432,893 lineal ft.

Commercial finned tube — 5,779,919 sq ft EDR in 1991, down 7.1% from the previous year's total of 6,219,467 sq ft EDR.

Finned tube — 1,121,934 lineal ft in 1991, down 8.2% from the 1990 total of 1,222,094 lineal ft.

Although there is not much hope for a substantial gain in new home starts in the Northeast this year, even a slight rebound in consumer confidence should produce at least a 5% gain in cast iron and steel boiler shipments to 311,000 units.

For the record, GAMA reported total gas-fired boiler shipments in 1991 of 183,903 units, down 9.9% from the 1990 total of 204,004 units. Similarly, it reported total oil-fired boiler shipments of 94,324 units last year, down 15.8% from the 1990 total of 112,069 units.

In previous years, we have also reported figures taken from the Bureau of the Census' Current Industrial Reports. The Bureau reports that, because of budget limitations, it has discontinued the annual MA-34N report covering heating equipment. It will produce a Census of Manufacturers report every five years instead. The next report, being compiled this year, probably will not be available until late 1993 or early 1994.

Commercial boilers

The commercial/industrial boiler market for 1992 is projected to reach 23.6 million pph (pounds per hour) of steam equivalency, down 10% from the 1991 sales total of 26.1 million pph, according to the American Boiler Manufacturers Association (ABMA).

The trade association reported that last year's sales were 2% above the actual 1990 sales level of 25.6 million pph. The forecast total for large industrial units in 1992 is 32.9 million pph, an increase of 9% over last year's total of 30.2 million pph but 2% lower than 1990 sales of 33.7 million pph.

1991 steel boiler shipments

Gross output, MBh	Oil-fired	Gas-fired	Bare	Total
Up to 100	4,847	92	351	5,290
101 to 125	8,404	102	599	9,105
126 to 150	4,642	28	416	5,086
151 to 175	2,209	5	198	2,412
176 to 200	736	33	18	787
201 to 300	519	15	8	542
301 to 500	154	30	7	191
501 to 750	53	34	4	91
751 to 1,000	23	19	8	50
1,001 to 1,400	17	4	4	25
1,401 to 2,350	11	19	3	33
2,351 to 3,350	0	0	0	0
Total	**21,615**	**381**	**1,616**	**23,612**

The cogeneration market for 1991 is being projected at 2,521 megawatts (MW). Forecasters are looking for a 32% decline this year to 1,709 MW. The 1992 figure is expected to be about 10% less than the total for 1990 of 1,911 MW.

Forecasters are projecting a combined 1.1 million pph for the purchase of both mass-burn and refuse-derived fuel (RDF) municipal solid waste units. This represents a 266% improvement over the 300,000 pph total for 1991. There were no sales of these units in 1990.

Watertube fluid bed combustion units are forecast at 5.1 million ppm in 1992, or 19% higher than the 1991 projected sales level of 4.3 million pph. The group includes both atmospheric and pressurized systems, although atmospheric units are the major players.

The Burner Group forecasts a 1992 market of 17,720 units, up slightly over last year's projected sales total of 17,207 units. The increase primarily will be in the below-25 million-Btuh category. Stoker shipments projected for 1992, at 21 units, should more than double 1991's total of 10 units.

For the record, ABMA expects combined domestic and export orders for utility boilers in 1992 to total 4,750 MW, a whopping 90% increase over the 1991 expected sales level of 2,500 MW. Although

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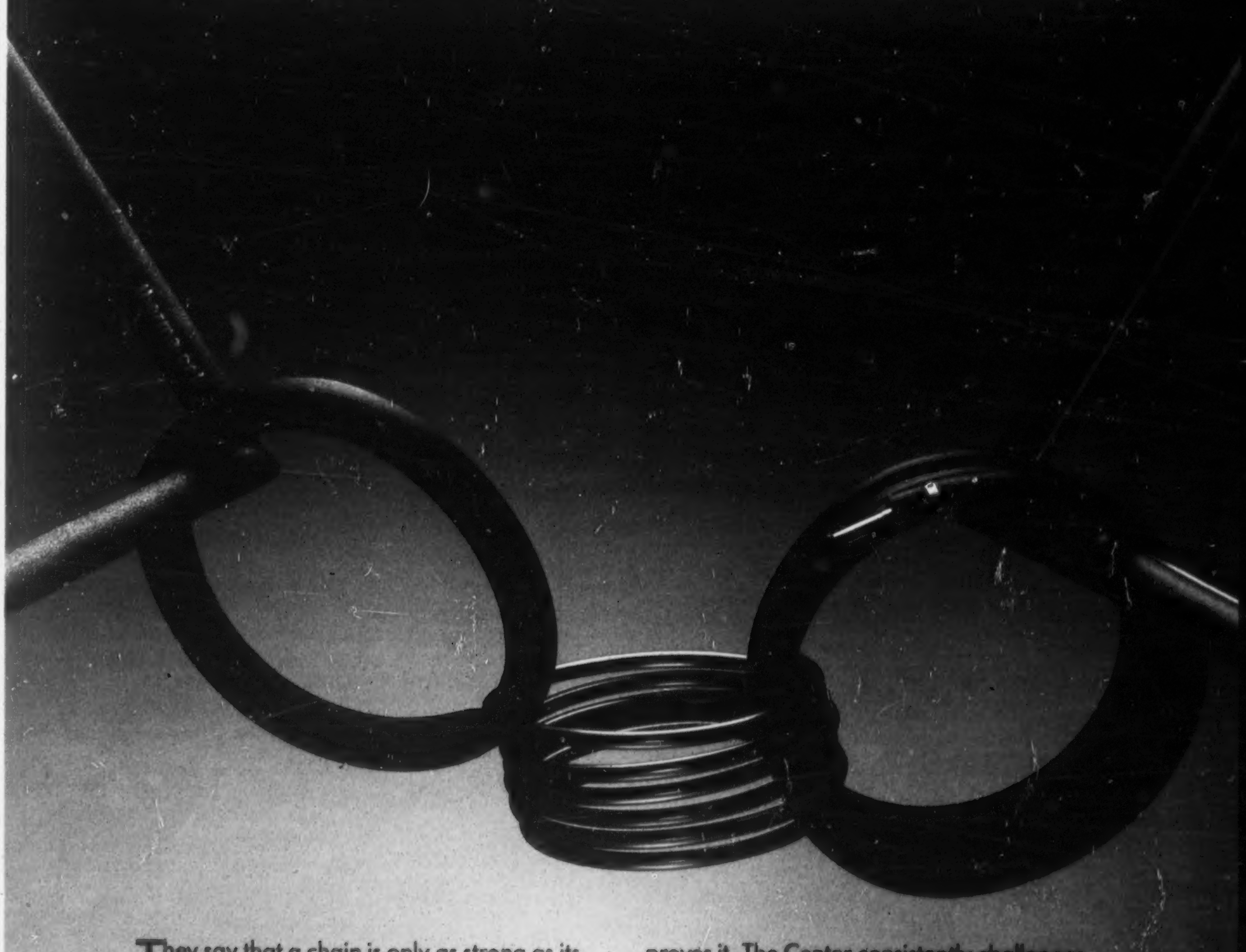

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(Continued from Preceding Page)

domestic sales accounted for a majority of the 1991 utility boiler market, export sales are expected to contribute 74% of this year's megawattage.

More gas products

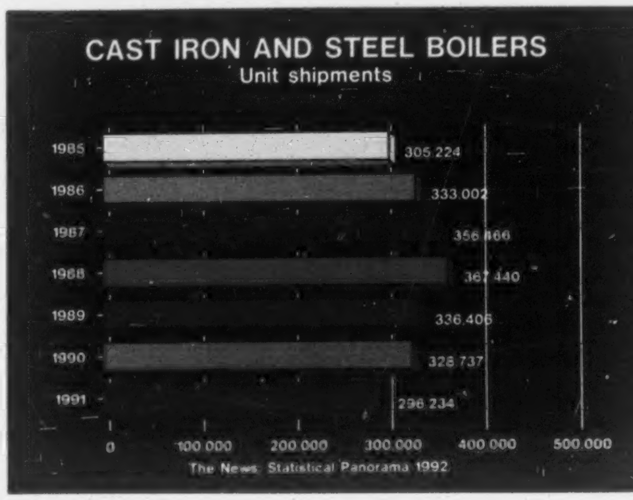
Shipments of **gas-fired unit heaters**, at 135,747 units in 1991, were down 14% from the 1990 total of 157,926 units, according to GAMA. This followed a similar drop in 1990.

Of the 1991 total, 129,695 were propeller fan-type unit heaters, down 13.3% from the year-previous total of 149,512 units. Another 6,052 were blower-type unit heaters in 1991, down 28.1% from the 1990 total of 8,414 units.

An average forecast by GAMA's members calls for a further reduction in 1992 for gas-fired unit heaters to 133,700 units. In 1995, however, they expect unit heater shipments to climb slowly to 150,300 units.

Gas-fired residential wall furnace shipments in 1991, at 147,320 units, were down 2.4% from the 1990 total of 150,930 units, according to GAMA.

Included in the category are vented wall furnaces, at 90,560 units in 1991, which showed a decline of 5.7% from the previous year's total of 96,060 units. Direct-vent wall furnaces, at 56,760 units last year, showed a 3.4% gain over the 1990 total of 54,870 units.



The category does not include wall furnaces installed in recreational vehicles, a category withheld by GAMA to avoid disclosing individual manufacturer production numbers. The total for 1988, the last year figures were available, was 235,518 units.

An average of GAMA member forecasts calls for a decline in wall furnace shipments in 1992 to 140,000 units and an increase in 1995 to only 145,000 units.

Shipments of **gas-fired floor furnaces** in 1991 totaled 15,225 units, a drop of 15.6% from the previous year's total of 18,042 units. GAMA's members expect floor furnace shipments to increase this year to 16,500 units and, in 1995, to increase to only 17,000 units.

GAMA reported that a total of 269,652 **gas-fired room heaters** were shipped in 1991, a decline of 15.1% from the year-previous total of 317,775 room heaters. Of the 1991 total, vented room heaters accounted for 57,082 units, down 20.8% from the 72,081 vented types shipped in 1990, and unvented room heaters accounted for 212,570 units in 1991, down 13.5% from the 1990 total of 245,694 units.

Looking ahead, GAMA's members expect shipments this year to be down a bit to 262,500 units and, in 1995, to increase to 300,000 units.

More about oil

Oil burner installations in 1991 totaled 427,000 units, a decline of 9.3% from the 1990 total of 471,000 installations, according to *Fuel Oil & Oil Heat* magazine. The publication reports dealer sales rather than manufacturer shipments.

Of these, 28,000 were installed in new single-family homes, down 26% from the 38,000 new home installations in 1990. New home installations totaled 85,000 in 1979.

The new home market in the Northeast, the prime market for oil-fired systems, peaked in 1986. Since that time, the new home construction market in that region has fallen steadily.

There were 178,000 separate oil burners sold last year, down 6.3% from the 190,000 separate burners sold in 1990. Unlike other systems, there is little or no price difference between old-style burners and the newer high-efficiency designs. As a result, the magazine reports that virtually all separate burners are retention-head or other high-efficiency types.

Fuel Oil & Oil Heat estimates that 135,000 oil furnaces were sold in 1991, down 12.3% from the 154,000 oil furnaces sold in the previous year. Another 114,000 oil-fired boilers were sold last year, down 9.5% from the 1990 total of 126,000 oil boilers.

Conversions to oil from other fuels totaled 18,000 in 1991, according to the magazine, down 38% from the 29,000 conversions reported in 1990.

Replacement sales in 1991 totaled 381,000 units, a decline of 5.7% from the 404,000 replacement sales made in 1990, according to the magazine.

Solar surge continues, but hvac uses minimal

From its peak in 1981, when 20,133,000 sq ft of solar thermal collectors were shipped, the solar collector industry declined to a low of 7,289,000 sq ft in 1987. But, in 1989 and 1990, there has been a significant resurgence — particularly in medium-temperature collectors.

Shipments of photovoltaic (PV) cells and modules also increased dramatically in the years 1989 and 1990, both of which exceeded the prior record of 12,820 peak kilowatts (Kp) set in 1982. In fact, the 1990 record shipment of 13,787 Kp was more than double the 6,850 Kp shipped as late as 1987.

As you may have noted, we have shifted formats this year. The Bureau of the Census reports, our past source, no longer issues an annual report (for budget reasons), so we have shifted to the DOE-Energy Information Administration report. Instead of unit shipments, the new format uses square feet for thermal units and peak kilowatts for photovoltaics.

EIA reported that 11,378,000 sq ft of solar thermal collectors were shipped in 1990, the latest year for which these data are available. That represents only a 0.9% decline from the year-previous total of 11,482,000 sq ft. It's still a long way from the record of 20,133,000 sq ft shipped in 1981.

Prime reasons for solar's initial growth were the 40% residential and 15% business tax credits supplemented by many states. When the federal tax credits disappeared in 1985, and oil prices dropped sharply a year later, the market took a nosedive.

The reinstatement of the business energy tax credit, at 15% for 1986 and 12% for the years 1987 through 1990, had little effect because the commercial market was small. Some state incentives remain.

EIA reported that exports in 1990 totaled 245,000 sq ft, or 2% of total shipments. Imports totaled 1,562,000 sq ft, or 14% of total shipments.

Low-temperature (below 110°F)

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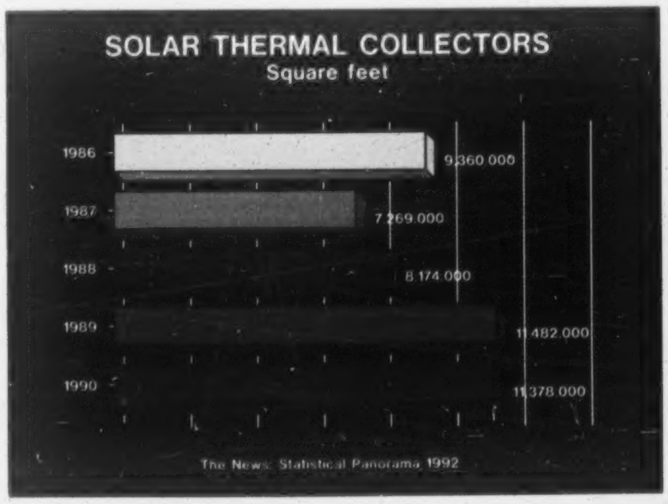
Each *Statistical Panorama* includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and earlier published data. Where sources give significantly varying information, that data is mentioned.



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(Continued from Page 18)

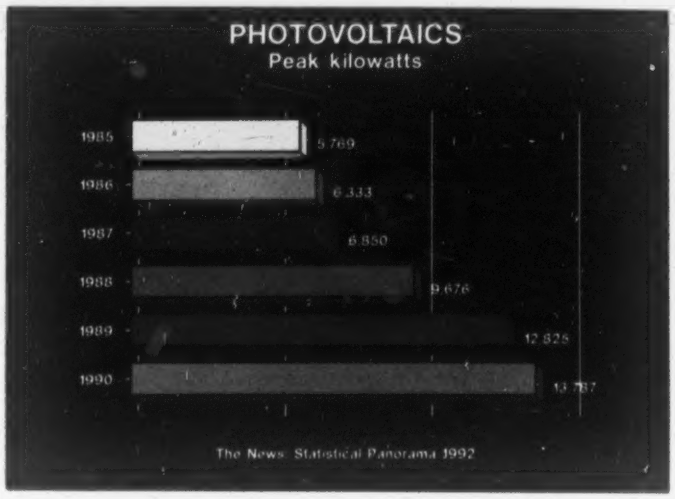
collector shipments totaled 3,621,000 sq ft in 1990, down 15.5% from the 4,283,000 sq ft shipped in 1989. These units, mostly used for swimming pool heating and low-grade water and space heating, accounted for 31.8% of the total.

Shipments of medium-temperature (110° to 180°) collectors in 1990 totaled 2,519,000 sq ft, an increase of 26.6% over the year-previous total of 1,989,000 sq ft. This group, which includes glazed flat-plate collectors and some evacuated-tube collectors, accounted for 22.1% of the total.

High-temperature (over 180°) collector shipments in 1990 totaled 5,208,560 sq ft, almost the same as in the previous year. This group, mostly parabolic dish or trough types used for electricity generation, accounted for 45.8% of the total. Most were imported.

Among the applications in 1990, electricity generation took a 45.8% share. Swimming pool heating had a 44% share. A distant third was domestic hot water heating, at 9.6%. The remaining 0.6% was shared by space heating, combination space and hot water heating, space cooling, and process heating.

The residential market accounted for 5.8 million sq ft, or 51% of the total in 1990, while electricity generation by utilities accounted for 5.2 million sq ft, or 46%. The average per sq ft price of collectors in 1990: high-temperature $15.74; medium-temperature $6.03; low-temperature $2.87; and medium-temperature air collectors, $5.61.



The News' Statistical Panorama 1992

Prime reasons for solar's initial growth were the 40% residential and 15% business tax credits supplemented by many states. When the federal tax credits disappeared in 1985, and oil prices dropped sharply a year later, the market took a nosedive.

Photovoltaics

Record shipments of photovoltaic cells and modules in 1990 totaled 13,787 peak kilowatts, an increase of 7.5% over the 1989 total of 12,825 Kp, the previous record. The record prior to 1989 was 12,620 Kp set in 1983.

Of the 1990 total, 11,400 Kp were PV modules (an array of PV cells assembled into panels) and 2,400 Kp consisted of single cells. The value of 1990 shipments by the 17 manufacturers was $73.8 million, up 20.8% from the 1989 total of $61.1 million.

Broken down by type, with the average module price in parentheses, the crystalline silicon types included 7,436 Kp of single crystals ($5.66) and 5,006 Kp cast and ribbon types ($5.68). Other types included 1,321 Kp of thin-film amorphous silicon ($5.65), and 24 Kp of concentrator silicon types ($12.28). The average cell price in 1990 was $3.84 Wp (peak watt), and the average module price was $5.68 Wp.

The communications market accounted for 31.3% of PV shipments in 1990, followed by electricity generation (25.9%), consumer goods (18.4%), water pumping and transportation, each with 7.3%. Exports in 1990 totaled 7,543,440 Wp and imports totaled 1,397,700 Wp, mostly from Australia, India, and Japan.

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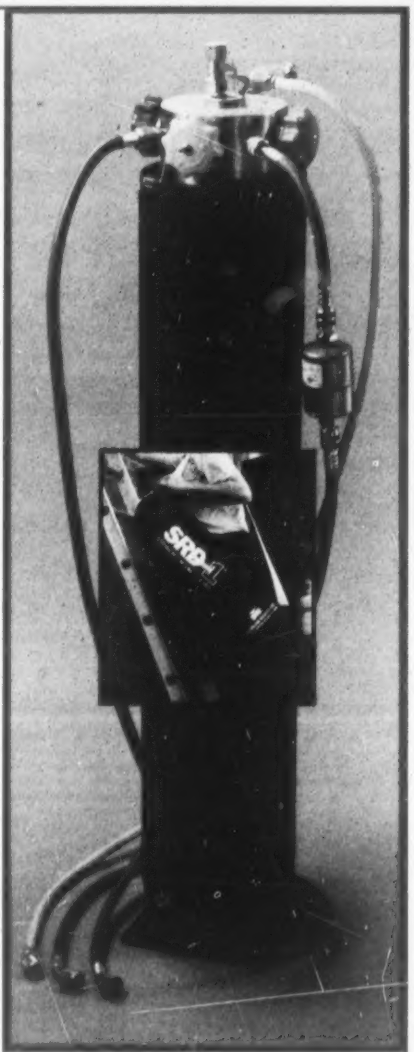

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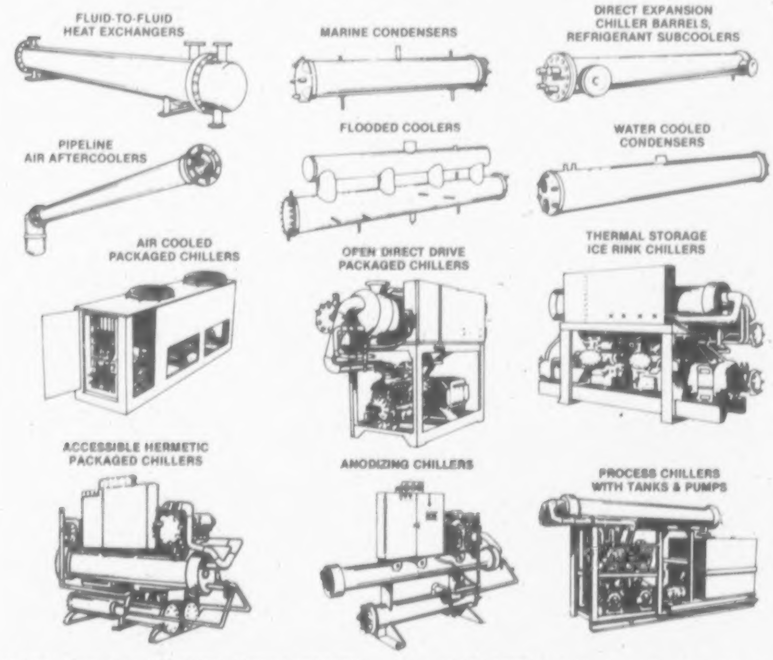
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Printed in U.S.A.

Circle 23

COMFORT AND CONSTRUCTION

Contractors in the hvac business for more than a decade can remember the days when gas furnaces were atmospheric, had a standing pilot, and were essentially a commodity. Some even referred to them as an extension of the ductwork.

They can remember, too, when most central air conditioners had an energy efficiency ratio between six and seven, had a single-speed compressor, small coils, and a high-speed condenser fan.

Few rooftops in those days were equipped with economizer cycles so they could use outdoor air when the temperature and humidity were right. And many were still using multi-zone units with leaky dampers.

For residential heating and cooling equipment, those days ended officially last Jan. 1. And for light commercial equipment, mandatory minimum efficiencies are just around the corner.

It has not been a sudden transition.

The efficiency of residential comfort cooling and heat pump equipment has steadily increased with the introduction of two-speed condenser fans and compressors, much-increased condenser and evaporator coil surfaces, slit fins and rifled tubing, and microprocessor controls. A few include variable-speed inverter drives for compressors, fans, and blowers.

For contractors, the change has been more dramatic on the heating side. The advent of induced-draft combustion, power burners, and pulse combustion has meant a whole new approach to venting. The standing pilot has been replaced by spark and solid-state ignition devices.

And importantly, first cost and maintenance have risen dramatically.

In the interim, the industry was flooded with setback thermostats, many produced by small electronics firms and sold in local hardware stores. Most newcomers to the thermostat marketplace have gone.

There also were devices to recover heat from flue pipes and room circulating fans designed to eliminate stratification. Wood stoves became a popular option — and remain so in areas where wood is reasonably priced.

A total of 265 manufacturers produced 18.6 million sq ft of solar thermal collectors in 1982, goaded by 40% federal tax rebates for homeowners and 15% for business. When the residential rebates ended in 1985, the industry slumped sharply.

It rebounded in 1989 and 1990 to 11.4 million sq ft (from 48 manufacturers), but most were used for electricity generation, pool heating, and domestic hot water heating. Comfort heating and cooling had miniscule shares.

Contractors active in large commercial and institutional markets found energy conservation was the watchword, particularly for renovation jobs. When energy prices moderated, the term used most often was return on investment. And, in late years, utilities have become heavily involved in incentives as they develop demand-side management programs.

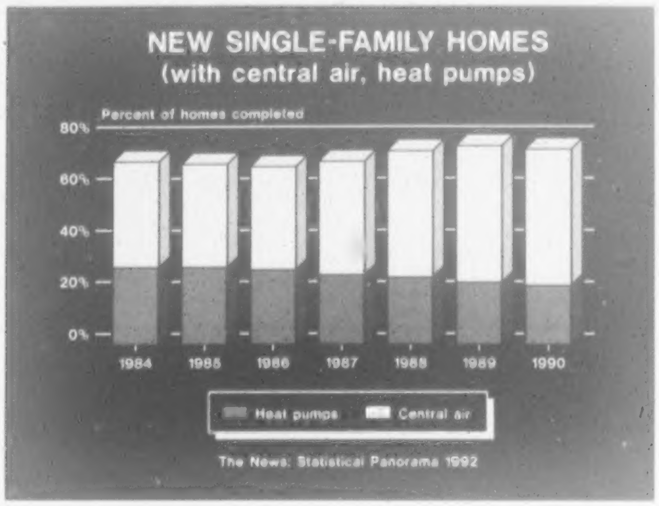
Many demand-limiting and duty-cycle systems were introduced, some of which were extremely hard on equipment and produced occupant discomfort.

A major thrust over the past few years has been the creation of a protocol that will allow building management systems of different manufacture to communicate with each other so that building systems can be upgraded using competitive bids.

On the industrial front, major energy-saving strides were taken quietly, mostly in the area of heat reclaim, recovery, and waste elimination. In macro terms, industry was the clear leader in saving energy.

On the regulatory front, work is already underway toward a revision of the federal mandatory efficiency standards — if necessary, by Jan. 1, 1994, under the National Appliance Energy Conservation Act of 1987 (NAECA).

The Department of Energy has indicated it will issue an advance notice of proposed rulemaking (anpr) in this regard later this year.



The News: Statistical Panorama 1992

Heating-cooling-fuel new home characteristics

	1989					1990				
	U.S. total	Northeast	Midwest	South	West	U.S. total	Northeast	Midwest	South	West
Single-family homes completed	**1,026,000**	159,000 15%	191,000 19%	420,000 41%	257,000 25%	**966,000**	127,000 13.1%	195,000 20.2%	389,000 40.3%	255,000 26.4%
Space heating fuel										
Gas	596,000 58%	81,000 51%	163,000 85%	158,000 38%	194,000 76%	573,000 59.3%	57,000 44.9%	169,000 86.7%	161,000 41.4%	186,000 72.9%
Electricity	352,000 34%	29,000 18%	22,000 11%	252,000 60%	49,000 19%	318,000 32.9%	24,000 18.9%	21,000 10.8%	220,000 56.6%	53,000 20.8%
Oil	50,000 5%	45,000 28%	— —	3,000 1%	— —	48,000 5%	43,000 33.9%	— —	3,000 0.8%	— —
Other/none	28,000 3%	4,000 2%	5,000 2%	7,000 2%	13,000 5%	27,000 2.8%	3,000 2.4%	4,000 2%	5,000 1.3%	15,000 5.9%
Heating system type										
Central heating	956,000 93%	149,000 94%	181,000 95%	395,000 94%	230,000 90%	904,000 93.6%	119,000 93.7%	187,000 100%	369,000 100%	228,000 89.4%
Warm air ducted	890,000 87%	91,000 57%	178,000 93%	393,000 94%	227,000 89%	845,000 87.5%	70,000 55.1%	183,000 93.8%	367,000 94.3%	223,000 87.5%
Warm air furnace	648,000 63%	73,000 46%	169,000 89%	206,000 49%	200,000 78%	623,000 64.5%	55,000 43.3%	173,000 88.7%	199,000 51.2%	195,000 76.5%
Heat pump	242,000 24%	19,000 12%	9,000 5%	187,000 45%	27,000 10%	221,000 22.9%	15,000 11.8%	10,000 5.1%	168,000 43.2%	28,000 11%
Hydronic	66,000 6%	58,000 36%	3,000 2%	— —	3,000 1%	60,000 6.2%	49,000 38.6%	4,000 2%	— —	5,000 2%
Built-in electric	37,000 4%	8,000 5%	7,000 4%	12,000 3%	10,000 4%	30,000 3.1%	6,000 4.7%	5,000 2.6%	10,000 2.6%	9,000 3.5%
Other built-in	33,000 3%	— —	3,000 1%	12,000 3%	17,000 6%	32,000 3.3%	— —	— —	10,000 2.6%	18,000 7%
With central air conditioning	785,000 77%	86,000 54%	139,000 73%	394,000 94%	164,000 64%	731,000 75.7%	63,000 49.6%	145,000 74.4%	369,000 94.9%	153,000 60%
Multi-family homes completed	**397,000** 100%	60,000 15%	76,000 19%	129,000 32%	131,000 33%	**342,000**	31,000 9%	68,000 19.9%	121,000 35.4%	121,000 35.4%
Space heating fuel										
Gas	167,000 42%	38,000 64%	51,000 67%	20,000 16%	57,000 43%	150,000 43.8%	22,000 71%	50,000 73.5%	20,000 16.5%	58,000 47.9%
Electricity	215,000 54%	16,000 27%	22,000 29%	109,000 84%	68,000 52%	182,000 53.2%	7,000 22.6%	17,000 25%	100,000 82.6%	59,000 48.8%
Oil	5,000 1%	4,000 7%	— —	— —	— —	3,000 0.9%	2,000 6.5%	— —	1,000 0.8%	— —
Other/none	11,000 3%	1,000 2%	— —	— —	— —	7,000 2%	— —	2,000 2.9%	1,000 0.8%	4,000 3.3%
Heat pump	105,000 26%	8,000 13%	2,000 2%	61,000 47%	34,000 26%	89,000 26%	1,000 3.2%	2,000 2.9%	60,000 49.6%	26,000 21.5%
With air conditioning	328,000 83%	49,000 81%	68,000 90%	127,000 98%	84,000 64%	280,000 81.9%	25,000 80.6%	61,000 89.7%	121,000 100%	73,000 60.3%
Mobile home placements	**203,000** 100%	20,000 10%	39,000 19%	113,000 56%	31,000 15%	**195,000**	19,000 9.7%	38,000 19.5%	108,000 55.4%	31,000 15.9%
With central air conditioning	100,000 49%	3,000 15%	16,000 41%	71,000 63%	10,000 33%	104,000 53.3%	3,000 15.8%	18,000 47.4%	72,000 66.6%	11,000 35.5%

SOURCE: Census Bureau. All numbers are rounded. Built-in "electric" includes electric baseboard, panel, or radiant heat. Built-in "other" includes room or space heaters, floor or wall furnaces, solar, and other types of heating.

COMFORT AND CONSTRUCTION

Basic marketing change

The advent of the pulse combustion furnace a decade ago also brought about a watershed in contractor marketing practices.

A suggested installation price of two to three times' that of an atmospheric gas furnace amused competitors — until it was proven that substantial numbers of homeowners in colder climates were willing to scrap inefficient furnaces in good working order to fuel savings in the 50% range.

Within two years, virtually every furnace manufacturer was offering a condensing furnace line. For the years 1987 through 1990, condensing furnaces captured more than 15% of the market. Last year, that share rose to 20.5%.

Furnaces

That was not the whole picture, however. As late as 1990, nearly six of 10 gas furnaces shipped had AFUEs (annual fuel utilization efficiencies) of less than the 78% federal minimum which became effective last Jan. 1. This means that, this year, many contractors must greet potential customers with the double price shocks of higher first costs *and* higher maintenance.

With the new standards in mind, the Gas Appliance Manufacturers Association (GAMA) changed its method of tracking efficiencies in 1990.

Of the total 2,056,670 gas furnaces shipped last year, 52.5%, or 1,078,633 furnaces, had AFUEs of less than the 1992 mandatory minimum of 78%. This total was down from 57.9%, or 1,130,162 furnaces shipped in 1990.

Of the remainder, 27% or 556,388 furnaces (up from 24.6% in 1990) had AFUEs of 78% but less than 88%, and 20.5% or 421,649 furnaces (up from 17.5%) had AFUEs of 88% or more.

These were the first significant increases in these categories since the move toward higher efficiencies stalled about 1986.

It was clear that there was a move late in the year to overproduce sub-minimum standard units to beat the deadline. The number is unclear, but we believe it was at least 150,000 units. Although they will be worked off of inventory during the year, they are bound to distort 1991 and 1992 shipment totals.

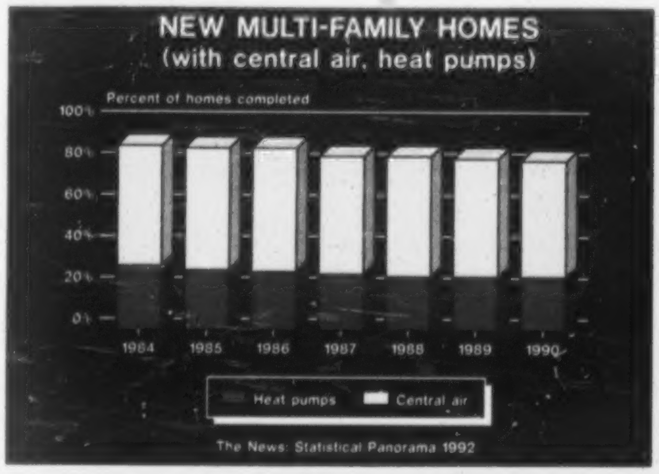
There should be no problems for contractors marketing oil furnaces in 1992, in terms of meeting the minimum efficiency mandate of 78% AFUE. Of the 131,245 oil furnaces shipped last year, 97% or 127,389 had efficiencies of 78% AFUE or more. Only 3%, or 3,856 oil furnaces, did not meet the 1992 minimum standard.

Meanwhile, the industry still debates whether or not it's best to use outdoor air for combustion.

Air-to-air heat exchangers, used more extensively in Canada to assure ventilation and prevent humidity build-up in tightly sealed homes, have not been widely accepted in the U.S. Work continues on getting local code approvals for plastic gas distribution piping within structures.

And, in conjunction with comfort cooling, there is a growing movement among manufacturers to use zoning dampers in larger homes,

(Page 26, Please)



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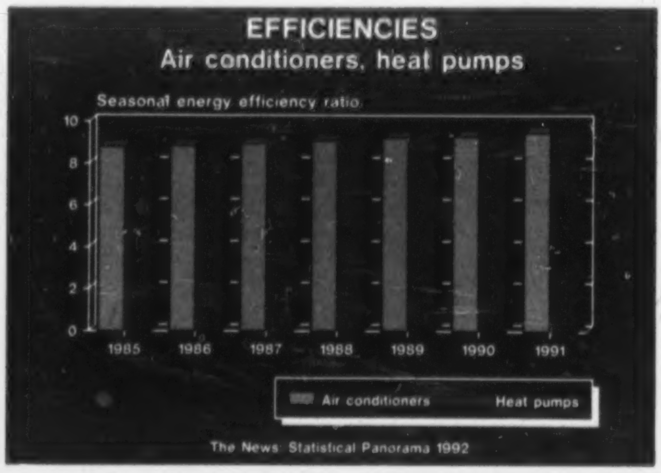

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Circle 16

COMFORT AND CONSTRUCTION

(Continued from Page 23)

instead of the multiple separate systems now preferred by contractors to achieve zoning.

The American Gas Association (AGA) reported that, in 1990, there were 218,951 conversions to gas from other fuels. Of these, 56,973 (26%) came from electricity, 118,216 (54%) came from oil, 25,206 (11.5%) came from LP gas, and 18,547 (8.5%) came from other fuels. AGA forecast there would be 300,000 conversions to gas last year.

On the other side of the coin, *Fuel Oil & Oil Heat* magazine reported that there were 18,000 conversions to oil from other fuels in 1991, down 38% from the 29,000 conversions reported in the previous year.

On the horizon are regulations, already in force in several California communities, which place strict (40 Ng/J) limitations on nitrous oxide emissions. Should these regulations spread, they will place heavy emphasis on the development of new burners and eliminate the return to a national market promised by the federal minimums.

Air conditioners

There was a time, not too long ago, when the central air conditioner market was dominated by new home starts. It was then that the low-cost (and usually low-efficiency) "builder" model dominated shipments.

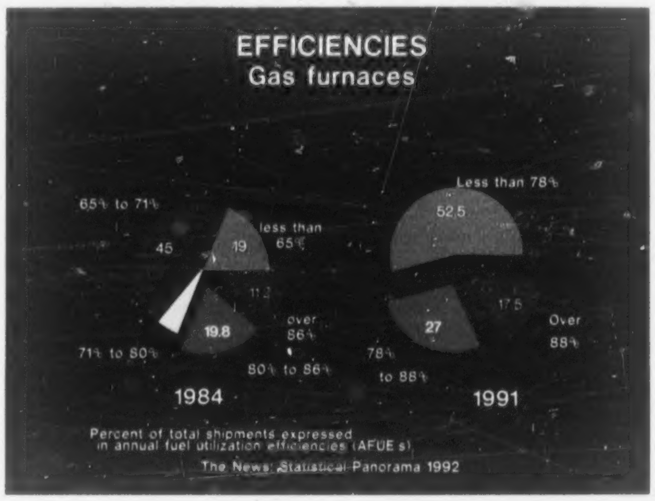
Those units going into the add-on or renovation market and the replacement market usually had more features.

But that, too, has changed. Although the add-on market has declined as more of the nation's homes are cooled with central units, the replacement market has grown steadily.

In 1991, for example, we estimate that only about 24% of cooling-only units went into new homes, while 60% were replacements.

The difference for contractors is dramatic.

Instead of selling a home builder who wants to add amenities for the lowest first cost, the contractor must now face the homeowner one on one and sell value. That means higher efficiencies, lower noise levels, and more reliability.



Percent of total shipments expressed in annual fuel utilization efficiencies (AFUE s)

The News' Statistical Panorama 1992

The Air-Conditioning and Refrigeration Institute (ARI) reported that, in 1991, the sales-weighted average of residential unitary air conditioners was 9.49 SEER (seasonal energy efficiency ratio), up from 9.31 in 1990. That's not far below the mandatory federal minimum SEER of 10 that became effective last Jan. 1.

Unlike furnaces, the transition to the federal minimum probably will produce only a minor sticker shock. ARI calculations indicated that, although only about 20% of shipments in 1990 exceeded the 10-SEER minimum, another 60% were between 9 and 10 SEER; only 20% had SEERs below 9.

A major benefit of the federal mandate is the elimination of state minimums. Not only did they create a number of mini-markets that destroy economies of scale, but the "me-too" and "me-toughest" syndromes promised much worse conditions in the future.

More important than state minimums in promoting higher cooling efficiencies have been the incentive programs launched by summer-peaking utilities. They find that a $300 to $600 incentive to homeowners and contractors for higher-efficiency equipment is less expensive than paying $1,500 a peak kW for new capacity.

Although we have not surveyed them lately, it would appear that utilities today are offering incentives for equipment with an SEER of 12 or above. There are many units available today with SEERs in the 12 to 14 range and some, equipped with variable-speed drives, have pushed to 17 and beyond.

The integration of domestic hot water heating can drive efficiencies even higher.

The number of gas utilities offering incentives to homeowners is much smaller and, for the most part, have involved no- or low-interest loans.

A growing number, however, are offering cash incentives to commercial and institutional customers who use gas for comfort cooling.

The fuel oil and LP gas industries, to the best of our knowledge, do not offer any efficiency incentives.

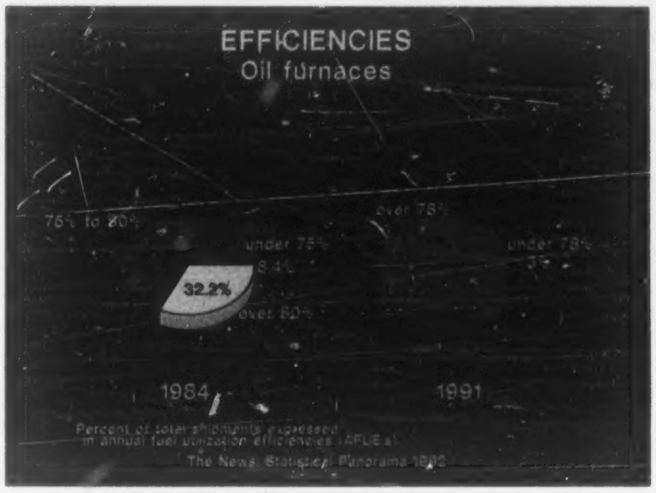
Heat pumps

Heat pumps remain largely a southern phenomenon, a factor amply illustrated by penetration rates in the South in 1990 of 43% for single-family homes completed and half of all multi-family units in that region.

Except for multi-family units in the West, the top for other regions was only a quarter of penetration rates in the South.

Electric furnaces usually go hand in hand with heat pumps. Used as a sole heat source with air conditioners mostly in the South, where cooling seasons are long and heating needs are minimal, they are also linked with heat pumps as a back-up heat source in colder climates.

A major reason for the modest decline in heat pump shipments has been the decline of housing starts in the South, dropping by 43.5% since 1986. This explains why heat pumps, which served 30% of all new single-family homes completed in 1985, declined to a 22.9% share in 1990.



Percent of total shipments expressed in annual fuel utilization efficiencies (AFUE s)

The News' Statistical Panorama 1992

A small market that surged more than a decade ago, then almost disappeared, is beginning a modest revival. It's the replacement of split-system air conditioners with heat pumps on gas and oil furnaces.

The heat pump provides summer cooling and heat during the spring and fall. The furnace takes over in the winter, or at a point determined by relative fuel prices.

The phenomenon is driven in today's market by electric utility efficiency incentives, which make up much of the heat pump's price premium. Some gas utilities resent the practice because they lose spring and fall revenues. They have tried to levy demand charges to recover some of that revenue.

The performance of air-to-air heat pumps has improved to a point where, in 1991, the 9.77-SEER sales-weighted average for residential units edged ahead of the 9.49 average for their cooling-only cousins for the fourth year in a row. The 1990 average for heat pumps was 9.46.

Like air conditioners, residential air-to-air heat pumps will have little difficulty meeting the mandatory 10-SEER minimum efficiency imposed last Jan. 1. The heating requirement is 6.8 HSPF (heating season performance factor).

It's significant that replacement air-to-air heat pumps, which by our calculations did not cross the 100,000-unit annual shipment threshold until 1985, accounted for 374,000 units in 1991. We believe that 53% of the residential heat pump market were replacements.

A relatively new approach, the integrated system, is enabling gas utilities to compete with heat pumps in some markets. It consists of a gas-fired water heater that provides both domestic hot water and space heating. An air conditioner evaporator or indoor heat pump coil can be added to the separate air handler equipped with a hot water coil.

Although they have yet to materially affect the heat pump market, they have allowed gas utilities to regain some of the apartment and condominium market lost when owners moved to individual metering. The gas industry, too, continues to push the development of gas-fired heat pumps.

Though their numbers are much smaller, water-source heat pumps using closed earth-coupled vertical or horizontal loops have been making themselves felt in northern markets, particularly in the Midwest. They have been used in the South, mainly in Florida, where a closed loop is unnecessary, for many years.

There are no reliable statistics for the number of earth-coupled closed-loop systems. We believe annual shipments are in the neighborhood of 20,000 systems.

Utilities in Indiana and Ontario, Canada, now offer incentives of up to $3,000 (which covers all or most of the ground-loop cost) because of their high efficiencies for both heating and cooling. A unit introduced this year, for example, boasts an SEER of 20.

The other breed of water-source heat pump — those connected to a building loop equipped with a small boiler and cooling tower to keep the loop between 60° and

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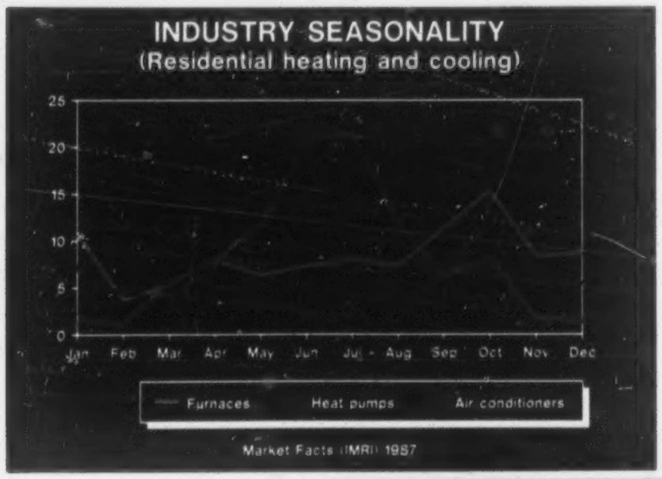

90°F — has suffered along with the decline in new commercial construction. They will have to wait until late 1993, at least, for an upbeat market.

Commercial systems

In the case of rooftop units and large commercial equipment, advances in compressors and in combustion systems have been supplemented by more widespread use of microprocessors and variable-speed drives for pumps, air handlers, and compressors.

Prime movers are shifting rapidly to refrigerants with no or much-less effect on the stratospheric ozone layer.

For rooftop units, there has been a move toward multiple compressors for better capacity control. Reciprocating compressors are being replaced by scroll compressors and even a few screw compressors.

Major manufacturers now have the capability of mounting microprocessors on both rooftops and field-engineered system components, so they can be operated locally or linked to a sophisticated central ddc (direct digital control) system.

Large control systems, once anchored to a custom computer, now use PCs routinely. Overlay communication networks and plug-in modules allow both pneumatic and electronic control components to work in harmony in the same building. Fire control, lighting, security, and other building systems can be controlled from a single console.

Open protocols, which allow new and old systems of different manufacture to operate together, already are in place in Europe and, in a more limited way, in the U.S.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is continuing its efforts to develop a BACnet open protocol for U.S. use. Meanwhile, the Intelligent Buildings Institute (IBI) is assessing the ASHRAE work and other open protocol approaches.

These control systems, which grew out of a need for energy management, now are being used as much to ensure comfort throughout a building as they are to save money on energy usage. They also have a major role to play in resolving the growing concerns about indoor air quality.

High electric time-of-day and seasonal demand rates also are pushing the development of cogeneration, water and ice storage systems, and desiccant cooling. All represent a comparatively small, but growing, market share.

And, on the near horizon, there are ice storage systems for residential applications.

We can look forward to more extensive use of inverter drives; microelectronics; scroll, screw, and dual compressors; enhanced heat exchangers and combustion techniques; and more integration of comfort and domestic hot water systems.

Commercial unitary air conditioning and heating systems also can look forward to national minimum efficiency standards by 1994.

The Senate began consideration of S. 2166, the National Energy Security Act of 1992, in February. It would establish minimum performance levels equivalent to those found in ASHRAE Standard 90.1, Energy Conservation in New Building Design Except Low-Rise Residential Buildings.

The standards would become effective for unitary air-cooled equipment with capacities less than 135,000 Btuh (11.25 tons) manufactured after Jan. 1, 1994, and for equipment with capacities of 135,000 Btuh to 240,000 Btuh (20 tons) manufactured after Jan. 1, 1995.

The standard for three-phase equipment with capacities of less than 65,000 Btuh (5.4 tons) would be the same as the present NAECA standard for single-phase units.

They would use ARI/ASHRAE rating and test procedures, and would pre-empt all state and local regulations.

Characteristics change

Although some trends are evident when comparisons are made from one year to the next (see table on page 23), a look at what's happened in new home construction over a five-year span offers a better perspective. There are several significant trends over the years 1986 through 1990. They include:

- The penetration of central air conditioning in new single-family homes continued upward from 69.9% in 1986 to 77% in 1989 only to fall back a notch to 75.7% in 1990. In the Northeast, half of new homes were equipped with

(Next Page, Please)

PORTRAIT OF COMFORT

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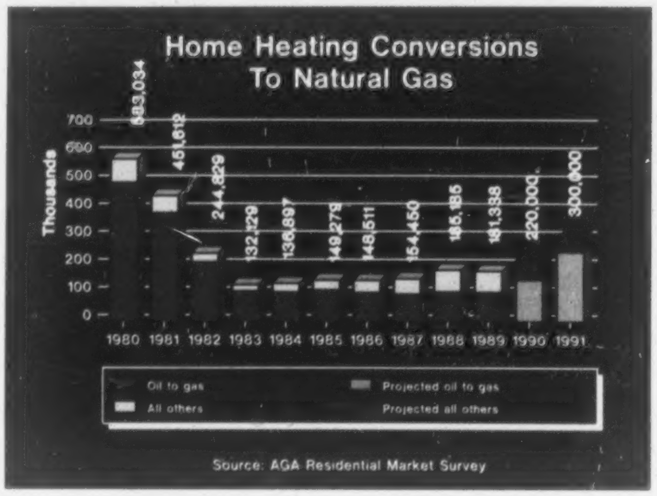
Circle 44 ⟶

(Continued from Preceding Page)

central cooling, even though room units are still popular there. Three-quarters of homes in the Midwest, 95% of those in the South, and six of ten in the West were equipped with central air conditioning.

- Among multi-family units, air conditioning slipped over the five-year period from 87.8% in 1986 to 81.9% in 1990. Most of the slippage came from a penetration decline in the West (from 72.2% to 60.3%) and a decline in the number of units built in the South, where penetration is 100%.
- In the battle of the fuels, the change for single-family homes continues to be dramatic. In 1986, gas (46.8%) led electricity (45.6%) by a hair. But, by 1990, gas had surged ahead to a 59.3% share of this market while electricity had slipped to a 32.9% share. Gas gained in all regional markets but it was in the relatively strong Midwest market, where gas is king, and the relatively weak South market, where electricity rules, that accounted for much of the swing.
- Oil, which held a 4.1% share in 1986, eased upward to 5% in 1990 largely because of its continued strength in the Northeast and moderating oil prices.
- In the multi-family market, electricity continues as king, but the throne is not as secure. Its share slipped from a commanding 64.5% in 1986 to 53.2% in 1990. Gas, meanwhile, increased its share from 33.4% in 1986 to 43.8% in 1990. Oil dropped only slightly from 1.3% to 0.9% over the same period. A major factor in the loss by electricity has been the declining share of multi-family construction in the South and, to a lesser degree, the penetration of gas-fired integrated systems.
- The 6% drop in single-family home heat pump penetration (from 29% in 1986 to 22.9% in 1990) is explained by its popularity — and lack of it — in regional markets. In the South, where the market has dropped by more than 40% over the past five years, penetration also slipped marginally from 44.8% in 1986 to 43.2% in 1990. Heat pumps in the Northeast and West accounted for 11% shares of much smaller markets and, in the Midwest, it was half of that.
- It was a slightly different picture for heat pumps in multi-family units where penetration dropped from 29% to a steady 26% for the three years 1988 through 1990. Most of the strength in 1990 was in the South (49.6% of all units) and in the West (21.5%). The Northeast (at 3.2%) and Midwest (at 2.9%) were hardly a factor.



Source: AGA Residential Market Survey

- In the case of other heating equipment in single-family homes completed in the years 1986 through 1990, the penetration of warm-air furnaces increased from 54.6% to 64.5%. The increases were across the board, but were most noticeable in the Northeast, which increased from 33.6% in 1986 to 43.3% in 1990.
- Hydronic heating systems, which held a 7% national share during the surge of construction in the Northeast in 1986 through 1988, slipped to 6% in 1989 and edged upward to 6.2% in 1990. In the Northeast, the bastion of hydronics, the hydronics market share increased from 33.6% in 1986 to 38.6% in 1990. The Midwest and West markets could only muster 2% shares.
- Built-in electric heat (resistance baseboard, ceiling cable, storage heaters), with its reputation for high operating costs, dropped from a 5.6% share of the new single-family home market in 1986 to 3.1% in 1990. The Northeast, with a 14.2% share in 1986, dropped to a 4.7% share in 1990.
- For the approximately 200,000 mobile homes placed in each of the five years 1986 through 1989, the penetration of central air conditioning held between 51% and 52% until 1990, when it increased to 53.3%.

It ranged from 15.8% in the Northeast to 66.6% in the South, which accounted for more than half (108,000) of the units. There was no meaningful difference between single- and double-wides.

Bright spots appear despite nonresidential market slide

Unlike most aspects of the recent balance sheet (or debt) recession, nonresidential construction still suffers from a more traditional inventory-generated recession that promises to last at least until late 1993.

If there's a silver lining, it's that remodeling expenditures appear to be rivaling new construction in terms of total outlays as building owners scramble to stay competitive in an overbuilt market.

Expenditures for nonresidential construction in 1991, at $80.491 billion, were down 11% from the 1990 total of $90.886 billion, according to F.W. Dodge Division of McGraw-Hill, Inc. The outlook for 1992 is for yet another decline, if only 2%, to $78.9 billion.

Industrial construction, at $7.7 billion in 1991, dropped 8% from the previous year's total of $8.378 billion, and is expected to fall by another 3% this year to $7.5 billion.

Instead of bricks and mortar, factory owners are concentrating on new machines and production methods to make them more competitive.

Office building construction, hampered by overbuilding and a national vacancy rate of nearly 20%, totaled $11.925 billion last year, down 33% from the 1990 total of $17.8 billion. The outlook for this year is for a flat market.

Although more recent figures are not available, the Bureau of the Census reported that the value of construction put in place for all projects in 1989 totaled $126 billion, of which $43.3 billion represented improvements (but not repairs).

The Department of Energy's triennial Commercial Buildings Energy Consumption Survey estimated that the market for improvements was $58 billion; another $54.9 billion was for upkeep.

The renovation market for nonresidential buildings keeps growing each year, we believe, and still presents a viable market for chillers, control systems, and other major components.

Construction of stores and other retail establishments, at $11.05 billion last year, was down 19% from $13.56 billion in 1990. The outlook for 1992 is for a more modest 4% drop to $10.625 billion. An improvement in this year's housing market promises that this market segment will improve somewhat in 1993, despite overbuilding in some areas.

Warehouse construction, at $5 billion in 1991, was down 20% from the year-previous total of $6.252 billion, but is expected to drop by only 1% this year to $4.925 billion.

Construction of garages and service stations, at $2.975 billion last year, declined by 19% from the 1990 total of $3.69 billion, according to F.W. Dodge. That market is expected to drop by another 7% this year to $2.775 billion.

The bright spots in construction again last year were educational and health care facilities.

Construction of educational facilities in 1991 totaled $17.525 billion, an increase of 12% over the previous year's total of $15.625 billion. A 3% drop in that market is expected in 1992 to $17 billion.

Construction of hospitals and other health care facilities totaled $9.15 billion last year, almost the same as the 1990 total of $9.14 billion. Only a 1% drop is expected in 1992, to $9.075 billion.

Government building construction, at $5.775 billion in 1991, was up 1% over the 1990 total of $5.694 billion. It's expected to drop by 3% to $5.575 billion this year, because of federal budget constraints and overspending by many state and local governments.

Other factors

The glut of office building space and multi-family residential units can be blamed, in large part, on two federal tax law changes.

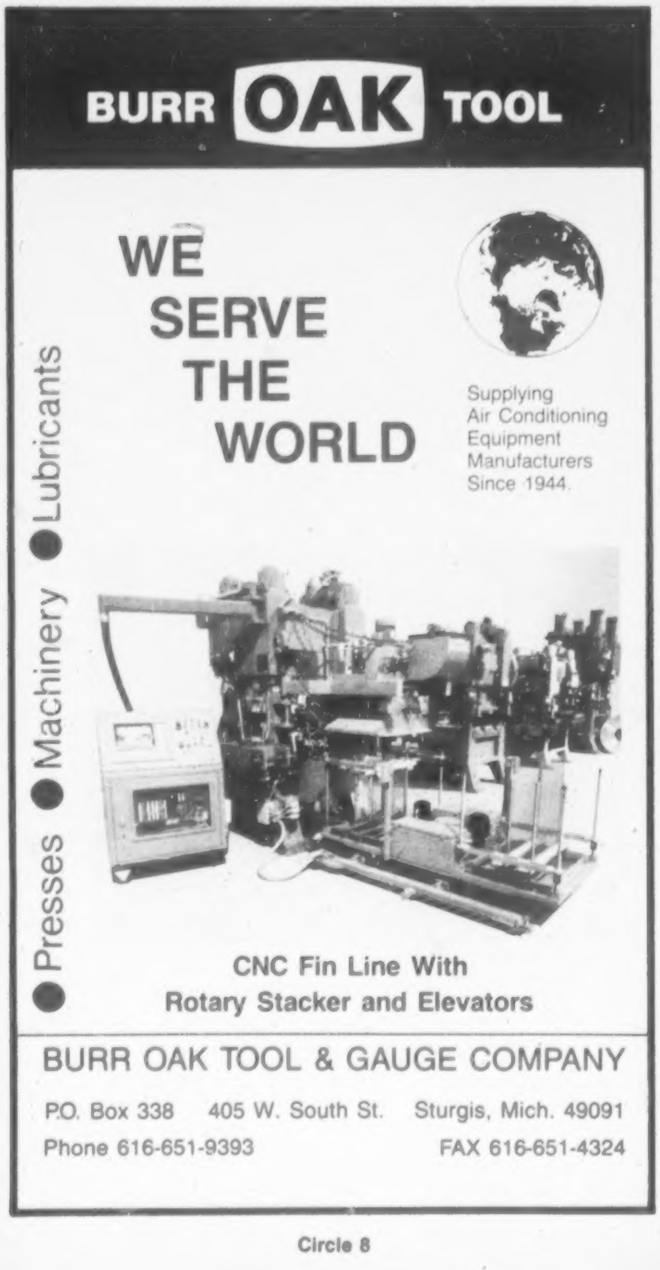
The first, in 1981, stimulated these markets by providing tax breaks for those investing in new buildings. The resulting syndicates had an obligation to build whether or not there was market demand.

The Tax Reform Act of 1986 changed all that.

Among other things, it raised the tax on capital gains, restricted passive loss provisions of the tax code, and lengthened depreciation schedules from 19 to 31 years. Artificially stimulated construction dropped drastically, and the nation was left with a huge overhang of office building space and apartments.

But here, too, is a silver lining for the hvac industry. Commercial banks and insurance companies, the major lenders for these projects, often insisted on being equity partners so they could share in expected property value increases.

But when the market virtually collapsed and they were left with ownership by default, they found that property values went down, not up, and they were left with operating costs that were eating them alive.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Circle 8

REFRIGERATION

Even though a tightening of credit and a low inflation rates have squeezed supermarket expansion and renovation budgets, shipments of commercial refrigeration equipment in 1991 increased by 1.3%, according to the Commercial Refrigerator Manufacturers Association (CRMA).

The trade association does not report numerical totals for total shipments, or for the various equipment categories.

Based on percentage changes reported by CRMA, the Bureau of the Census, and other sources, *The News* estimates that shipments of refrigerated cases in 1991 totaled 102,200 units, up 1.3% from the year-previous total of 100,900 units. Shipments in 1990 registered a 1.7% decline, the first downturn in a decade.

CRMA reported that 1991 shipments of standard-temperature meat display cases were down 38.5% from the previous year. But, as we shall soon see, the decline was not as serious as it would appear.

Included in this group was a drop among single-duty, self-service cases of 51.8%, and a decline of 16.7% in double-duty multi-decks from the previous year's totals. This group formerly accounted for about a quarter of total shipments.

Much of the decline in meat display case figures was artificial, CRMA explained, because of the introduction of a new specialty merchandiser category that drained away many units formerly classified as meat cases. It will be another year before the comparisons are compatible.

The new category includes floral cases and special cases for pizza, cheese, and other products. Another new category, service cases, includes fixed and lift-up straight and curved fronts for meat, seafood, and deli products. Here again, comparisons will not be available for another year.

Shipments of low-temperature display cases, which make up more than one-third of all commercial refrigeration shipments, increased by 2.6% in 1991 over the total for the previous year. Within that group, single-deck unit shipments were down 14.6%, and shipments of multi-decks equipped with glass doors increased by 16.4%.

Shipments of open multi-deck freezers, however, were down by 16.1%. Shipments of island-type freezers last year declined by 30.1%, according to CRMA.

The trade association no longer provides figures for walk-in coolers. A planned statistical program covering unit shipments and dollar values for units usually sold to convenience stores died for want of willing participants.

Some perspective

The supermarket industry continues to be deluged with problems.

Even though interest rates dropped dramatically in 1991, operators found credit was tight and much of the money they could borrow went into restructuring high-interest debt. And, although the prices of many items dropped during the year, a highly competitive marketplace in a recessionary economy, coupled with low inflation rates, put an additional squeeze on profits.

Despite these pressures, however, supermarkets were forced to make some moves to counteract growing threats from wholesale membership clubs, mass merchandisers, and upgrading competitors.

To meet these challenges, a quarter of them were adding service seafood, in-store bakeries, delis, and floral cases. They also were restructuring existing departments, such as frozen foods, to meet the influx of new products and changing shopper preferences.

Much of the change over the past few years has involved the addition or rearrangement of refrigerated cases. And, although figures aren't in for the number of last year's new stores and remodels, early indications are that the average of 1,200 to 1,300 new store additions was not reached in 1991.

On the other hand, the average of 2,500 to 3,000 store remodels probably was surpassed in 1991 because of many minor upgrades. Because many of these remodels involved refrigerated cases, industry shipments ended on a positive note.

Which leads to another major problem faced by the supermarket industry.

Refrigerant concerns

CFC-12, used for standard-temperature display cases, and R-502 (a 50-50 azeotrope of HCFC-22 and CFC-115), used for frozen food and ice cream cases, are being phased-out because of their alleged contribution to stratospheric ozone depletion.

If President Bush has his way, the elimination of CFC production will take place by 1995.

To meet this challenge, supermarket operators already have started to use HCFC-22 in both single- and two-stage systems for freezers. Most appear to favor the simpler single-stage systems, but earlier experience with near-term compressor failures and high energy costs has left them uneasy.

In addition to high discharge temperatures, they are concerned

(Page 31, Please)

Circle 45 ——>

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Bureau of the Census data

A 10-year look at air conditioning and refrigeration unit shipments

Product	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Condensing units	439,714	[illegible]	456,538	440,383	415,096	424,052	424,344	408,834	399,706	414,265
Compressors and compressor units	[illegible]	[illegible]	[illegible]	22,774,859	19,739,483	22,939,132	23,240,375	25,185,928	24,075,067	21,237,030
Ammonia compressors	1,808	1,509	1,173	1,233	1,140	1,252	1,886	1,190	2,090	1,936
Screw compressors[1]	5,320	2,620	3,601	—	—	—	—	—	—	—
Fancoil units[2]	253,932	297,232	214,729	209,051	185,263	205,731	237,804	254,778	264,474	250,037
Induction units[3]	—	—	—	—	—	—	—	—	—	—
Central-station air handlers	59,866	58,961	56,301	53,413	59,008	61,363	59,359	66,292	69,736	63,683
Unitary air conditioners[4]	1,991,507	1,568,838	2,067,152	2,448,677	3,419,063	3,668,380	3,047,919	4,100,173	4,398,831	3,651,392
Unitary heat pumps (air-to-air)	684,903	406,742	660,956	803,669	865,939	871,057	872,401	849,238	986,396	834,530
Water-source heat pumps	69,889	86,092	69,290	86,165	118,164	103,970	142,033	149,795	157,089	139,351
Packaged terminal air conditioners	143,427	135,741	150,073	184,780	119,123	145,591	135,214	65,528	82,306	64,709
Packaged terminal heat pumps[1]	32,439	52,512	58,753	93,549	96,155	105,984	98,312	55,443	50,076	42,955
Room air conditioners	3,722,509	2,883,156	1,668,075	3,039,491	2,665,825	3,053,412	3,126,270	3,708,034	3,872,564	3,454,344
Centrifugal chillers[5]	3,938	3,893	4,089	2,289	4,025	3,903	3,726	1,453	1,667	1,559
Reciprocating chillers	12,090	11,668	10,533	13,788	14,064	12,604	13,242	14,868	17,082	16,775
Absorption chillers	239	199	135	153	131	—	1,411	880	1,673	1,486
Adsorption, open-type absorption	3,171	1,461	1,044	1,087	1,057	—	—	—	—	—
Cooling towers[2]	15,381	11,222	11,344	10,853	11,083	10,348	10,085	10,934	12,529	9,059
Evaporative condensers	2,859	2,166	2,149	2,426	2,505	2,282	2,382	2,182	2,424	2,265
Mobile vehicle air conditioners	6,059,342	5,651,329	9,267,612	12,196,385	13,008,516	—	9,752,154	13,474,829	14,140,444	13,562,498
Mobile air conditioners for trucks, agricultural, construction equipment[3]	834,174	1,064,381	1,657,050	1,948,655	2,154,467	—	2,266,282	3,325,126	4,817,186	4,497,727
Mobile vehicle refrigeration systems	66,773	68,843	66,502	36,548	44,916	—	—	—	60,070	60,800
Recreational vehicle air conditioners[1]	119,566	142,227	156,689	173,914	172,833	177,842	—	232,591	244,164	223,576
Unit coolers	169,487	163,697	187,612	179,726	205,282	186,301	200,296	199,354	176,423	177,315
Ice-making machines	165,626	150,475	166,399	218,261	201,068	202,936	243,512	243,771	195,959	200,818
Drinking water coolers	432,733	373,560	429,258	528,043	584,743	695,386	740,614	932,672	984,061	886,175
Dehumidifiers	540,386	438,833	610,013	586,003	589,056	484,981	580,399	—	—	—
Humidifiers (central and self-contained)[1]	396,413	310,342	324,948	427,504	370,585	410,782	454,295	504,568	504,568	447,602

Source: Bureau of the Census, Current Industrial Report MA-35M, Air-Conditioning and Refrigeration Equipment, Including Warm Air Furnaces. [1]New category since 1980. Screw compressors now included in automotive air conditioning compressors by Census Bureau; included with centrifugal compressors in industry figures. [2]Includes vertical stack units. [3]Withheld to avoid disclosing operations of individual companies. [4]For years 1980 through 1984, add these figures to those for unitary heat pumps (air-to-air) and subtract exports to get comparable industry figures. [5]Excludes open-type units. Also excludes units 200 hp and under and units over 400 hp for 1988 through 1990.

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(Continued from Page 29)

that the life of HCFC refrigerants may also be limited. They have moved slowly in adopting HFC-134a, which has no effect on the ozone layer, to replace CFC-12 for standard-temperature systems.

In early 1992, Du Pont announced four new developmental refrigerants that could change current practice. Its "Suva" HP81, an HCFC-based blend of HCFC-22, HFC-125, and propane (R-290), is offered as an interim replacement for R-502. It will be available in commercial quantities in July.

Suva HP81 is a near-azeotrope that's nonflammable and remains so during a vapor leak. It provides discharge temperatures lower than HCFC-22, cooling performance and energy efficiency similar to R-502, and a slight increase in refrigeration capacity, Du Pont reported.

Suva HP62, a proprietary HFC-based blend for medium- and low-temperature commercial refrigeration applications, is targeted for commercialization in 1993. With its zero ozone depletion and minimal contribution to global warming, the manufacturer sees it as a long-term replacement for R-502.

It provides lower discharge temperatures than HCFC-22, although slightly higher than those for R-502. Its refrigeration capacity and efficiency values are equal to or better than R-502 at operating conditions typical of low-temperature systems. Toxicity testing is underway.

Both blends are intended to replace R-502 in a broad range of applications, including supermarket frozen food cases, ice machines, and transport refrigeration, with minimal system modifications, according to John Bray, business manager, Du Pont Fluorochemicals.

Du Pont says it is evaluating Suva HP80, which contains the same components as HP81 but with discharge temperatures equal to or less than R-502. Aimed at transport refrigeration applications, it will be commercially available this summer.

For medium-temperature commercial refrigeration applications in restaurants and convenience stores, Du Pont introduced Suva MP39, one of a series of proprietary ternary mixtures of HCFC-22, HFC-152a, and HCFC-124.

Its performance characteristics include comparable capacity and energy efficiency to CFC-12. "It can be easily retrofitted into units now using CFC-12 and, in some cases, requires slightly fewer amps than CFC-12 systems," said Bray.

Supermarket sales

Total sales of the nation's 30,750 supermarkets in 1990 amounted to $271.7 billion, an increase of 5.5% over the previous year, according to *Progressive Grocer*.

It was lower than the 1989 increase of 7.16%, but greater than the average compounded growth rate for the previous five years of 5.19%.

Of the supermarkets, chains accounted for $189.8 billion in sales in 1990, or 70%, and independents accounted for $81.9 bil-

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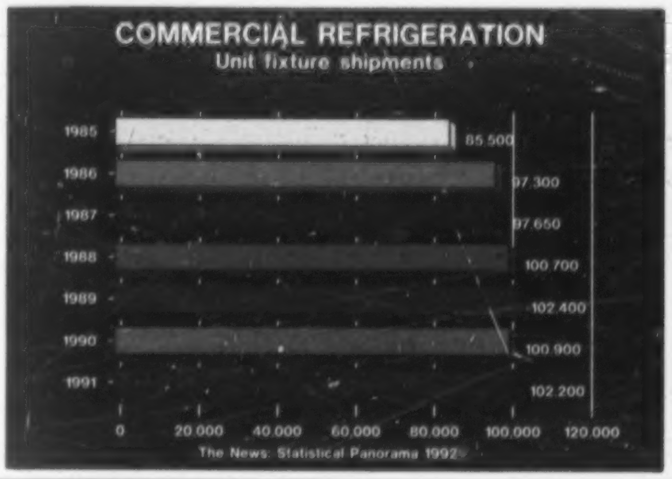
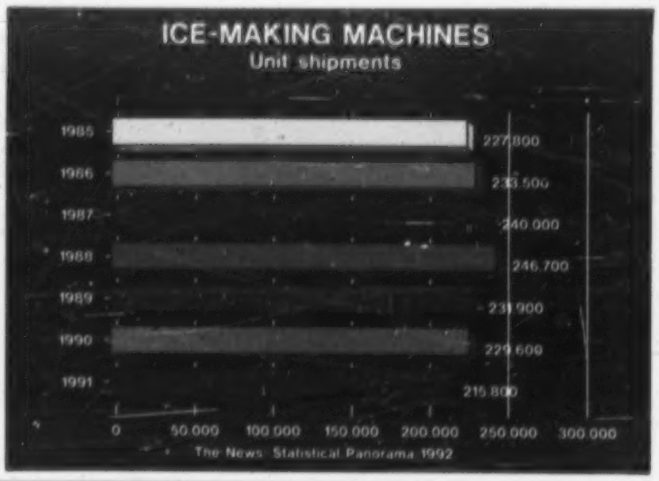


The News: Statistical Panorama 1992



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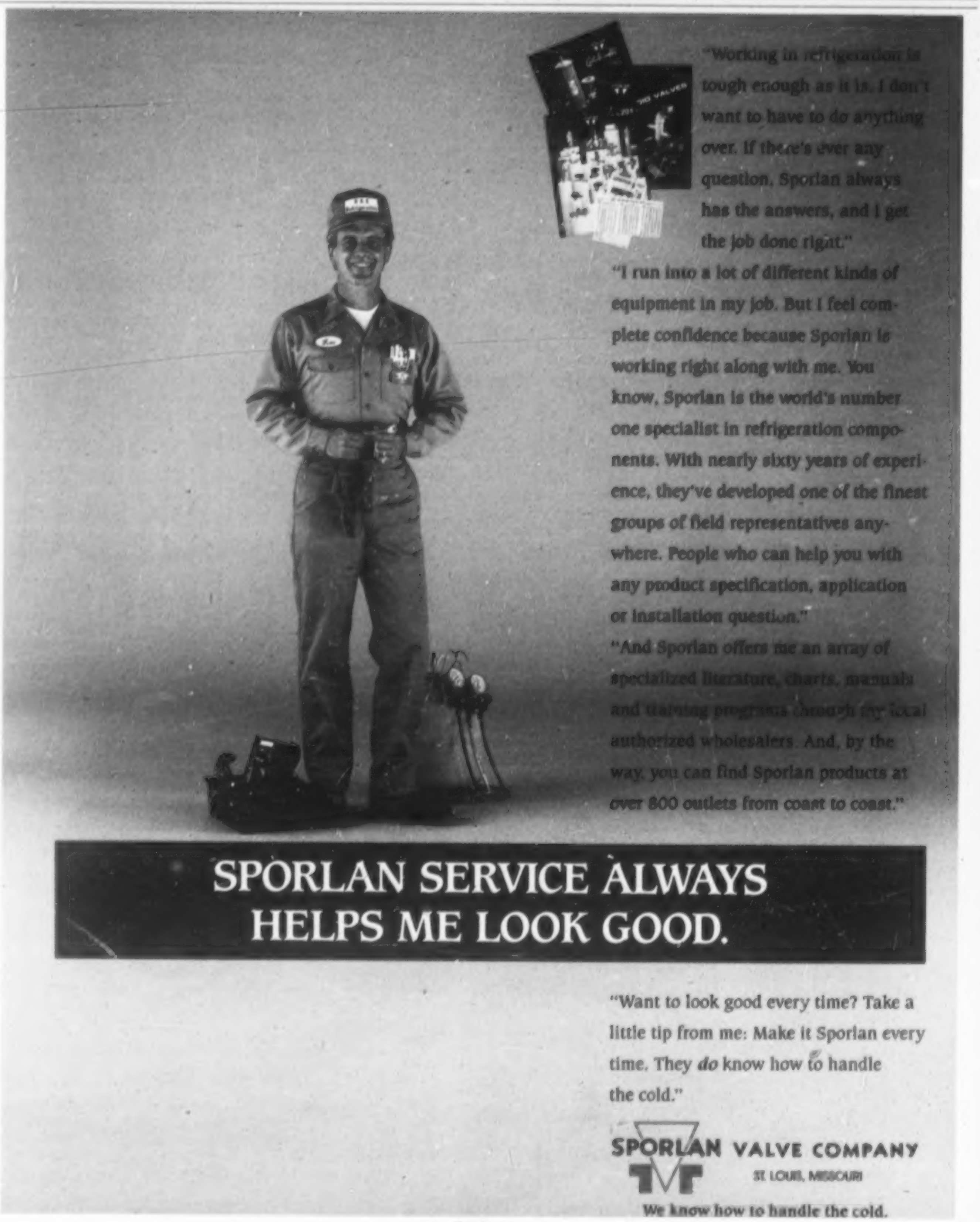
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Circle 40

(Continued from Preceding Page)

lion, or 30%.

Energy costs, which averaged $5,406 per month for independents and $8,776 for chains in 1990, were listed as a major problem by more than six of 10 supermarket operators, according to the magazine.

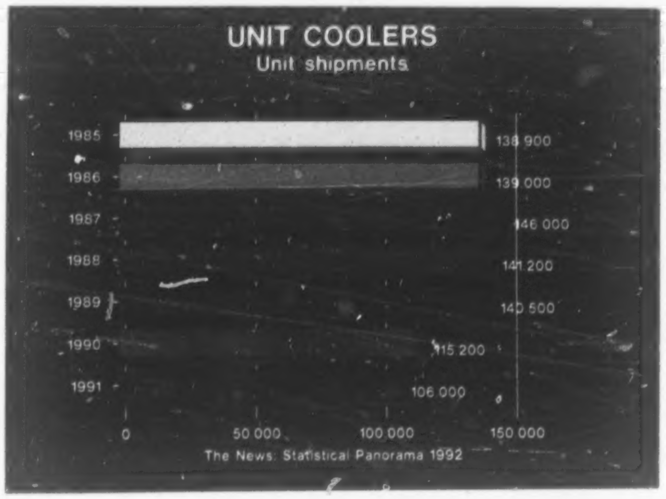
Nearly half of those surveyed reported buying heating and air conditioning equipment; 10% to 20% said they bought deli, meat, dairy, bakery, glass door, or open well refrigerated cases during that year.

Half of that number bought salad bars, service fish cases, or open multi-decks. Energy control devices were purchased by 10% of independent operators and 15% of chain operators. The average spending by independents for this equipment in 1990 was $76,700.

Median store size, which grew from 33,000 sq ft in 1980 to 46,900 sq ft in 1987, appears to have stabilized at about 40,000 sq ft. The average age of supermarkets was 18.6 years for independents, 14.6 years for chains. The average price of an independent supermarket remodel was $124,500.

Among the major concerns of supermarket operators is the growing number of wholesale membership clubs, where food accounts for half of sales, and the addition of foods among mass merchandiser outlets.

A few of the larger chains also are moving away from regional and local buying to centralized purchasing in order to get better control of supplier prices.



Convenience outlets

According to *Progressive Grocer*, the nation's 56,000 convenience stores, or 38.6% of total outlets, racked up sales in 1990 of $26.9 billion (exclusive of gasoline sales), or 7.3% of grocery sales. Other grocery stores accounted for 58,200 outlets, or 40.2% of the total, and sales of $69.9 billion, or 19% of the overall total of $368.5 billion.

On the other hand, *Convenience Store News* reports there were 81,800 convenience stores in the U.S. in 1990 and another 2,700 in Canada. Of these, 79.3% also sold gasoline. For the U.S. outlets, the average gasoline sale was $8.58 and the average grocery sale was $3.25.

The magazine reported that total merchandise sales in 1990 amounted to $44.519 billion, of which $32.165 billion was food sales. The average outlet size was 2,300 sq ft. Nearly one-third (31%) were planning to build new stores, and a quarter were either expanding current stores, acquiring others, or expanding food service departments.

Restaurants

The National Restaurant Association (NRA) reported that total sales for all eating places in 1991 amounted to $161.77 billion, an increase of 1.4% over performance in 1990.

NRA said ice cream and frozen-treat places showed the only decline (0.4%), but the nation's restaurants could muster only a 0.9% gain.

A combination of the recession economy and the Gulf War, which kept people at home watching television, had major impacts last year. NRA expects overall eating place revenues to increase by 1.9% this year to $171 billion, and restaurant receipts to increase by 1.3% to $83.2 billion.

Tabs at bars and taverns, which declined by 7.6% in 1991 to $8.55 billion, are expected to shrink by another 2.7% this year to $8.32 billion.

Among food contractors, with projected 1992 sales of $16.15 billion (a 3.6% increase over 1991), the biggest gains will be recorded by airline feeding, health care facilities, industrial cafeterias, and colleges and universities.

Food service in lodging places is expected to increase by 1.5% to $15 billion this year, while the institutional market is expected to grow by 1.4% to $28 billion.

The billion-dollar military market, which declined by 5.3% last year, is expected to drop by another 4.2% in 1992.

A forecast prepared for the International Foodservice Manufacturers Association (IFMA) by Technomic, Inc., calls for a real 1.5% increase in total industry sales in

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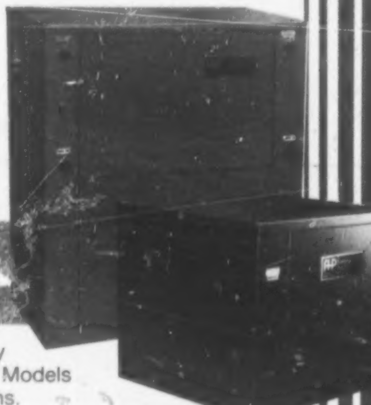
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1992 to $275.5 billion.

The increase, which will fail to keep pace with the industry's expansion rate, means that a significantly larger number of restaurants will be vying for a slice of a pie that is only marginally larger. Individual operators may be lucky to realize a 1.5% increase in sales.

Refrigerators

Home refrigerator shipments totaled 7,273,000 units in 1991, a 2.4% increase over the previous year's total of 7,101,300 units, according to the Association of Home Appliance Manufacturers (AHAM).

Shipments of home freezers in 1991 totaled 1,414,100 units, an increase of 9.1% over the 1990 total of 1,296,000 freezers. Of the 1991 total, 794,300 (56.2%) were chest-type freezers, up 9.8% over the year-previous total of 723,100 units. Another 619,800 (43.8%) were upright types, up 8.2% from the 1990 total of 572,900 units.

As with all of AHAM's published statistics, the figures include products made in the U.S., exports, and those imported from other countries.

Unit coolers

Shipments of unit coolers, at 106,000 in 1991, were down 8% from the previous year's total of 115,200 units.

Meanwhile, the Bureau of the Census reported that 177,315 unit coolers were shipped in 1990, the latest year for which these data are available. That represents a 0.5% increase over the 176,423 unit coolers the Bureau said were shipped in 1989.

The industry figures do not include exports or the figures of several significant manufacturers.

Ice makers

Commercial ice maker shipments in 1991 totaled 215,800 units, a 6% decline from the 1990 total of 229,600 units.

The Bureau of the Census reported that 200,818 commercial ice makers were shipped in 1990, the latest year for which these figures are available. That represents a 2.5% increase over the 1989 total of 195,959 ice makers.

Of the 1990 total, 67.6% were cubers, 7.2% were flakers, and 25.2% were either not self-contained or combination ice or drink dispenser units.

The News cannot explain the difference between industry and government figures, because both include domestic and export shipments. Some have suggested that the government figures include small residential ice makers, not included in industry totals.

Each *Statistical Panorama* includes the latest data available. Sources frequently revise their previous year's figures, which explains apparent discrepancies between the latest and ealier published data. Where sources give significantly varying information, that data is mentioned.

Even though housing starts dropped for the fifth year in a row and resales were flat, the market for power humidifiers held up remarkably well. We blame much of the decline over the past two years to the precipitous drop in consumer confidence.

Shipments of power humidifiers in 1991 totaled 463,000 units, a drop of 6% from the 492,000 power humidifiers we believe were shipped in 1991. It follows a 14% decline in the previous year.

In years past, industry executives reported that nine of 10 power humidifiers are installed in existing homes. Most of those installed in new homes come a year or two after occupancy.

In recent years, however, a growing number of merchandising contractors are quoting on humidifiers along with furnace or air conditioner replacements. This factor, together with a trend toward larger, more expensive homes, has helped keep shipment levels strong in the face of declining new home sales.

It should be noted, too, that new home starts in the humidifier's prime Midwest market dropped by only about 20% over the past five years; those in the South and West dropped by more than twice that much; and those in the Northeast dropped by three times' as much.

A 1989 survey conducted by *The News* revealed that two-thirds of the contractors who responded said they always tried to sell a humidifier with a new furnace. More than a quarter said they installed 10 to 20 humidifiers in the previous year; another quarter said they installed 20 to 40 units.

Of those installed, 18.7% went into new homes, 29.4% were first installations in existing homes, 34.7% were sold with replacement furnaces, and 17.2% replaced existing humidifiers.

Three out of four contractors said sales of portable humidifiers through retail outlets did not hurt them.

For the record, the Bureau of the Census reported that 447,602 power humidifiers were shipped in 1990, the latest year for which these data are available. That represents a decline of 11.3% from the 504,568 humidifiers the Bureau said were shipped in 1989.

The Bureau also reported that 3,022,303 portable humidifiers (including vaporizers) were shipped in 1990, a decline of 31.9% from the 4,437,797 portable humidifiers the Bureau said were

(Next Page, Please)

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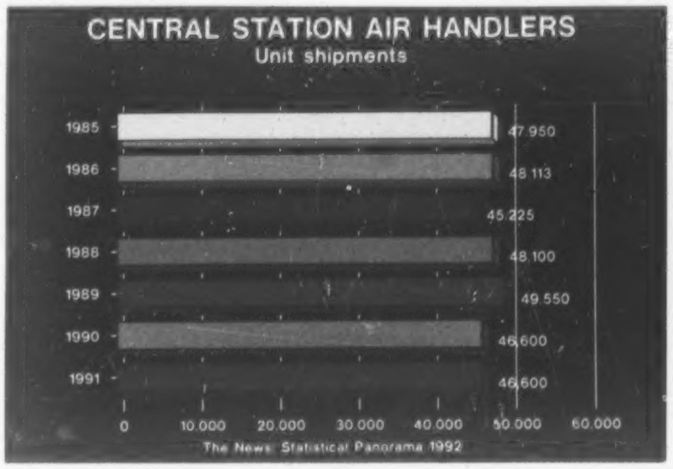

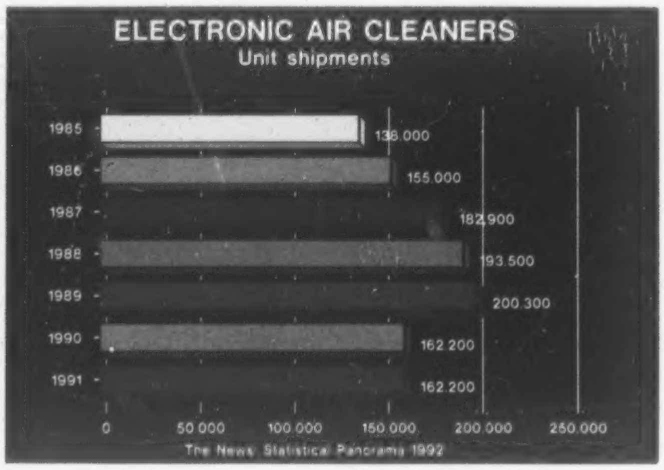

(Continued from Preceding Page)

shipped in 1989.

Central station air handlers

Shipments of central station air handlers in 1991 totaled 46,600 units, almost identical with the performance of this product group in 1990.

For the record, the Bureau of the Census reported that 63,683 central station air handlers were shipped in 1990, the latest year for which these data are available. That represents a decline of 8.7% from the 69,736 central station air handlers the Bureau said were shipped in 1989.

Of the central station air handlers the Bureau said were shipped in 1990, draw-through units represented 88.3% of the total and blow-through units represented 11.7%. Not included in these totals are heating and ventilating types.

Electronic air cleaners

It would appear that electronic air cleaners, after steady increases from the 1982 recession through 1989, have stabilized after a 19% drop in 1990.

Shipments of electronic air cleaners in 1991 totaled 162,200 units, virtually the same total as in the previous year.

The efforts of mechandising contractors and a growing awareness of indoor air quality, while not strong enough to prevent some decline in an era of sinking home starts and consumer confidence, have had a positive effect.

Another factor is that, as homeowners pay more for higher efficiencies, some tend to leave the purchase of accessories for another day.

A major eac producer, Honeywell, believes eac's represent a $500 million untapped market for contractors. With the U.S. saturation of eac's at only 5%, the company is in the midst of a five-year program to include an eac with every fourth furnace, central air conditioner, or heat pump installed.

Eac's have a special compatibility with heat pumps because of their ability to keep the indoor coil clean in winter, when there is no condensate to remove airborne dust.

They also help remove short-lived radon daughters that characteristically attach themselves to dust particles. Eac's cannot, however, remove radon gas.

Dehumidifiers

Shipments of dehumidifiers in 1991 totaled 840,000 units, according to the Association of Home Appliance Manufacturers (AHAM). This represents a 13.1% increase over the 742,500 dehumidifiers AHAM said were shipped in 1990.

AHAM said the hurricane that swept the Southeast in 1990 and heavy rains in the nation's midsection last year contributed to the high shipment levels. It fore-

(Page 36, Please)

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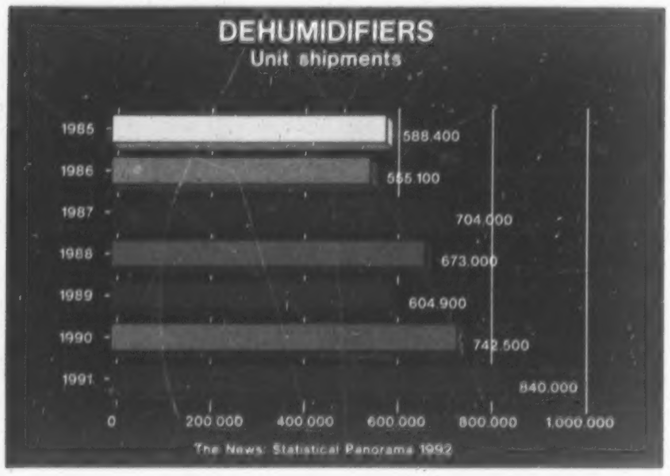


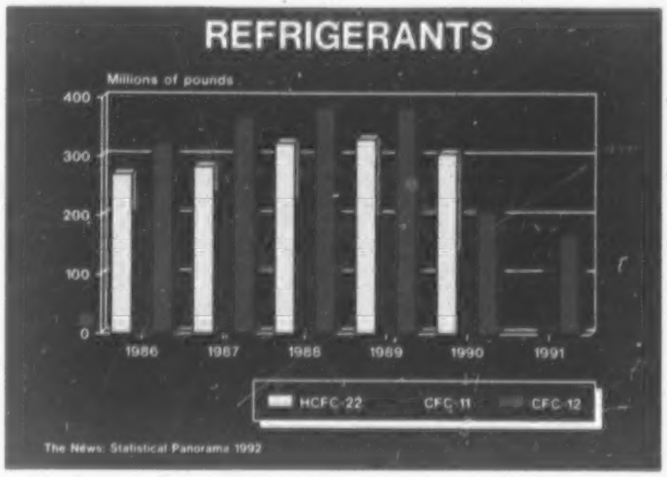
The News: Statistical Panorama 1992

(Continued from Page 34)

casts that shipments in 1992 (750,000 units) and 1993 (700,000 units) will be down significantly.

The Bureau of the Census did not report unit shipments for the years 1989 and 1990, the latest for which these data are available. It did report, however, that the total dollar amount for shipments in 1990 was $86,156,000, an increase of 18.8% over the 1989 total of $72,514,000.

Refrigerants



The News: Statistical Panorama 1992

U.S. production of two common CFC refrigerants — 11 and 12 — totaled 268,388,004 lbs in 1991, a decline of 21.9% from the 1990 total of 343,615,570 lbs, according to the U.S. International Trade Commission.

Production of CFC-11 last year totaled 98,790,331 lbs, down 26.8% from the 1990 total of 135,091,274 lbs. Under federal mandate, the production cap in 1991 was set at 85% of the 1986 production level of 201,921,781 lbs. In reality, however, 1991 production was down 51% from the 1986 mark.

Production of CFC-12 in 1990 totaled 169,597,673 lbs, a decline of 18.7% from the previous year's total of 208,524,296 lbs. The decline from the 1986 reference year's production of 324,008,942 lbs was 47.6%.

Full-year production figures for HCFC-22 were not available. Production of 22 for the first three quarters of 1991 totaled 234,714,944 lbs, an increase of 1% over the 232,437,592 lbs produced in the same period of the previous year. The 1990 full-year total was

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- Alternative refrigerants
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306,064,618 lbs.

Production of CFCs in 1992 is limited to 80% of the 1986 reference mark — hardly a factor at a time when production of these refrigerants is only about half of 1986 production. On Jan. 1, however, the tax on CFC-11 and -12 increased from $1.37/lb to $1.67. Next Jan. 1, the tax will increase to $2.65/lb.

The tax is determined according to the ozone depletion potential (odp) of the individual refrigerant. CFC-11 and -12 have an odp of 1. R-502, for example, has a much lower odp. The tax on R-502 increased on Jan. 1 from 41¢/lb to 50¢/lb; next January, it will increase again to 80¢/lb.

Other impacts

Sparked by new scientific findings on ozone depletion in October, 1991, there will be many major impacts on the hvacr industry this year. But because the regulations have yet to be issued, we recommend that readers continue to monitor future issues of *The News* for details as they become available.

For background:

As a follow-up to the 1987 Montreal Protocol (with world market impact) and EPA regulations limiting CFC production, Congress enacted Title 7 of the Clean Air Act in 1990, to phase out the production of CFCs by the year 2000; the use of HCFC-22 in new equipment by 2020; and no HCFC-22 production after 2030.

Last December, the Natural Resources Defense Council, Friends of the Earth, and the Environmental Defense Fund petitioned EPA to accelerate the ban on CFC production to the end of 1994. It also asked that HCFC-22, HCFC-141b, and HCFC-142b not be used in new equipment after the year 2000, and that production be eliminated by the end of 2004.

Meanwhile, the Bush Administration has called for an accelerated phaseout of CFC production from 60% of 1986 levels in 1992 (already exceeded last year), to zero in 1996, and a reconsideration of the phaseout of HCFC-22 to 2005 for equipment, 2015 for refrigerant production.

The industry responded in February with support for the accelerated phaseout of CFCs by 1996, but a modification of the ban on HCFCs.

The position, developed by ARI, was supported by virtually all other affected trade associations in the U.S. and by the International Council of Air Conditioning and Refrigeration Manufacturers' Associations (ICARMA), which represents hvacr trade associations of Canada, Japan, Europe, and the U.S.

In the case of HCFC-22, HCFC-141b, and HCFC-142b, the industry group countered with a production ban for new equipment by Jan. 1, 2010, and a total ban by Jan. 1, 2020. The existing Clean Air Act dates for HCFC-123 (2020 for new equipment, a total production ban by 2030) would remain in force.

"Banning the use of HCFC-22 in new equipment any earlier than 2010 will discourage CFC users from switching to it and will cut short the evaluation of potential substitutes, possibly forcing the wrong refrigerant choice," said Arnold Braswell, ARI president, in a letter to EPA.

In an attempt to hasten the development of substitutes for HCFC-22 — there are no proven substitutes now — ARI is administering an Alternative Refrigerants Evaluation Program, being undertaken by 11 U.S. manufacturers. It will involve compressor calorimeter testing, heat transfer analysis, and full system tests, mostly by the participating companies.

Results of the tests of 10 refrigerants and blends, expected early in 1994, will be publicly available through the refrigerant database administered by the Air-Conditioning and Refrigeration Technology Institute (ARTI).

While this is going on, EPA is directed by the Clean Air Act to develop regulations associated with a ban on intentional venting of CFCs after July 1 of this year, and HCFCs by the end of 1995.

The regulations will include mandatory certification of ratings of recovery-recycling equipment, of reclamation facilities, and of technicians.

The notice of proposed rulemaking (NOPR), expected to be made in late April, will contain a 45-day response period. Obviously, enforcement of the July 1 ban on intentional venting will be pushed ahead, as will the certification programs.

The industry is awaiting publication of an ARI certification directory based on ARI Standard 740-91, "Performance of Refrigerant Recovery, Recycling, or Reclaim Equipment." This program could be used to cover "on-site" recovery and recycling requirements, with the possible addition of the percent of charge recoverable with the equipment, but ARI Standard 700 is likely to be used as the purity standard for "off-site" reclamation.

Technicians will be required to pass EPA-approved competency exams that may be developed and administered by private national organizations. Such examinations would be supervised by EPA, which has indicated it would consider grandfathering for participants in prior certification seminars, provided provisions are made for later supplementary training to bring them into compliance.

EPA also expects to issue an advance notice of proposed rulemaking (ANPR) covering emission-reduction opportunities for such industry segments as retail food, cold storage, auto air conditioning, chillers, and process refrigeration. In the case of chillers, for example, EPA is focusing on improving purging technology.

(Next Page, Please)

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REPLACEMENT MARKET

Historically, replacements have provided a stabilizing market influence for contractors, enabling them to shift emphasis with changing economic conditions — at least most of the time.

In 1991, with housing starts down for the fifth year in a row and the economy in recession, replacement sales were expected to shine. It didn't happen because another market ingredient, consumer confidence, had also slipped.

With the exception of residential heat pumps, most hvac product replacement sales were flat last year. A few, such as gas furnaces and central air conditioners, gained by a hair while others, such as residential boilers, slipped a bit.

It could have been much worse. Utility incentives helped generate sales opportunities that might not have existed otherwise. And contractors, with the help of a few manufacturers, are exploring new (for them) merchandising techniques to uncover potential customers from their own and purchased lists.

Within the past half dozen years, contractors have also discovered another profitable market — the replacement of older equipment in good working order with high-efficiency units.

Although the saving of energy is obvious, most use the argument, "Where can you get a better investment opportunity or return on investment."

A macro view

Before examining individual industry markets, it's significant that national expenditures for residential alterations, repairs, and replacements have grown from $45.2 billion in 1982 to $106 billion in 1990.

The real growth, in constant dollars, came in the period of 1983 through 1986. It has since leveled off.

Although final figures for 1991 are not available, it's expected that the total declined by about 6%. Importantly, however, all of the growth over the past two years has been confined to maintenance and repairs — and at the expense of the more expensive alterations and replacements.

Some industry analysts are expecting a 9% recovery in 1992, a reflection of relatively low interest rates and growing consumer confidence. A poll of builders attending the National Association of Home Builders (NAHB) convention in January revealed that 44% expect remodeling activity in 1992 will be good to excellent (down from 69% a year earlier), and 53% expect it to be fair (up from 28% in 1991).

Heating and air conditioning alterations and repairs, at $7.46 billion in 1988, accounted for 7.4% of the total. It included $2.751 billion for maintenance and repairs, $1.367 billion for additions and alternations, and $3.352 billion for major replacements such as furnaces, boilers, central air conditioners, and heat pumps. Contractors did 93.8% of all jobs.

RELATED PRODUCTS

(Continued from Preceding Page)

A future batch of regulations, which probably won't become effective until 1994, will set a lowest achievable emissions level (LAEL) for various applications. The Clean Air Act also requires EPA to issue a list of safe alternatives for CFCs and HCFCs by Nov. 15.

In January, EPA issued an ANPR and request for data aimed at chemical producers, formulators, and equipment manufacturers as a preliminary step in its significant new alternatives policy (SNAP).

An outcome will be a list of substitutes prohibited for specific uses, and a list of acceptable alternatives for those prohibited applications.

The advance notice states that EPA will assess such factors as health risks, ecological toxicity and exposure, chlorine loading, ozone depletion potential, global warming potential, flammability, and economic feasibility in the near term.

Warning labels on refrigerant cylinders and refrigerant-containing equipment also are being considered.

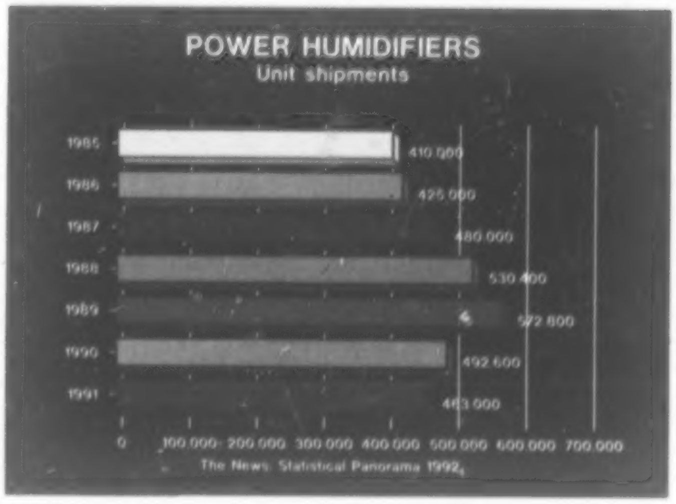
Meanwhile, California's South Coast Air Quality Management District (covering parts of Orange, Los Angeles, Riverside, and San Bernardino counties) prohibited venting as of Jan. 1, 1992, and requires systems containing more than 50 lb of refrigerant to be leak-checked annually.

Leaking systems must be fixed within 14 days. There is a $10,000 bounty for whistle-blowers, and a fine scale of up to $25,000 for violators. Already more than 250 auditors — mostly contractors — have been appointed.

Additional complications come from marketing-oriented competitive statements from manufacturers about the advantages and disadvantages of using HFC-134a (substitute for CFC-12) and HCFC-123 (substitute for CFC-11) in liquid chillers.

And, just as supermarket operators had settled into a routine of using HCFC-22 as a substitute for R-502 in low-temperature systems and as a substitute for CFC-12 in medium-temperature systems, a chemical producer announces the development of short- and long-term proprietary blends as replacements for R-502 (see "Refrigeration" section on page 36).

At the same time, compressor manufacturers continue to develop machines that are compatible with the new substitutes. It's a fluid situation that probably will continue for at least the next two years.



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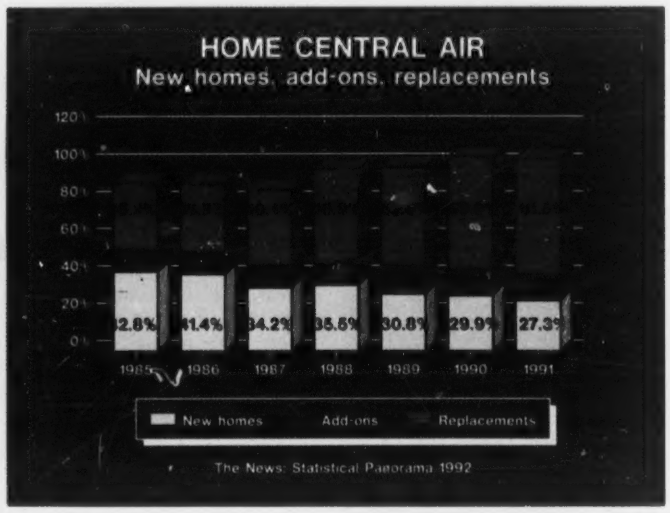
REPLACEMENT MARKET

Air conditioning

For easier understanding and better accuracy, the replacement market for unitary air conditioners should be separated into four parts — residential and commercial comfort cooling, and residential and commercial heat pumps.

If we separate 764,067 heat pumps from the 1991 unitary total of 3,770,363 unitary air conditioners, we get 3,006,296 comfort cooling units. Of these, 88% or 2,645,541 were residential units and 12%, or 360,756 were commercial units.

The residential-commercial split matches the latest determination of the Air-Conditioning and Refrigeration Institute (ARI). If you're comparing this split with that found in the Air Conditioning section, remember that this one doesn't include heat pumps.


HOME CENTRAL AIR
New homes, add-ons, replacements

The News: Statistical Panorama 1992

Of the 2,645,500 residential cooling units shipped in 1991, we estimate that 629,980 went into new construction (533,280 into single-family homes and 96,700 into multi-family homes).

These figures are arrived at by multiplying the penetration rate for air conditioning (less the heat pump penetration rate), by the known number of housing starts.

The new single-family air conditioning and heat pump totals were increased by 20% in 1991 to reflect the extra units going into larger homes to accomplish zoning. That factor had been as high as 25% in 1989, when a larger portion of big homes were built. We estimate that an average of 2.1 units went into this portion of 1991 homes.

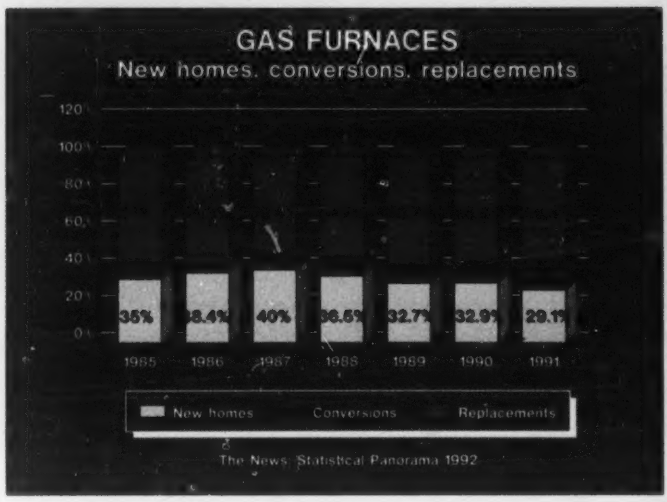
Replacement of central residential central air conditioners in 1991 totaled 1,586,300 units, or 60% of residential cooling-only shipments. This represents a 10% increase over the revised 1990 total of 1,442,000 units, partly because of the warmer summer in key markets and partly because of utility incentives.

Add-on or modernization units for homes not previously cooled with a central system enjoyed the lion's share of the market in the 1960s and 1970s. The percentage dropped to about 12% in the 1980s, but a lower rate of new home sales and utility incentives have boosted the share to about 14% in recent years. We estimate 375,000 units were add-ons in 1991.

Other factors included 91,000 central air conditioners in new mobile homes, and another 41,000 mobile home replacements. There was also a reduction in inventory of 77,800 units.

It must be remembered that central air conditioners or heat pumps have been installed in more than 40 million U.S. homes.

In the period 1976 through 1979, for example, shipments of cooling-only units grew from 1.3 million to 2.1 million units, and heat pump shipments grew from 312,000 units to 504,000 units. Most of these are in a prime replacement category.


GAS FURNACES
New homes, conversions, replacements

The News: Statistical Panorama 1992

Commercial

Of the 360,756 commercial comfort cooling units shipped last year (up 5% from the revised total of 343,500 units shipped in 1990), we estimate that 162,340 units, or 45%, were replacements. The remaining 198,416 units went into new construction.

As late as 1985, we estimated that 70% of commercial unitary air conditioners went into new construction. Although there are no benchmarks, we estimate that the replacement segment has been growing steadily. Some estimate that it's nearing 60% of the total.

Heat pumps

Of the 764,067 air-to-air heat pumps shipped in 1991, we estimate that 672,379 (88%) were residential units. Of these, 237,700 went into new site-built homes (192,700 into single-family homes and 45,000 into multi-family units), and 30,000 units went into mobile homes.

Residential heat pump replacements in 1991 totaled 314,679 units (46.8% of shipments), up 9.9% over the 286,200 replacement units shipped in 1990. Add-ons accounted for another 90,000 units last year. Inventories also were reduced by 43,200 units.

Although the new home market in the South, the prime market for heat pumps, has dropped by 43.5% since 1986, we suspect that replacements and utility incentives have injected some new strength.

Because utility incentives sharply reduce the premium paid for heat pumps over straight-cooling units, we suspect that many are replacing worn-out or inefficient cooling units with heat pumps in order to save on operating costs in the spring and fall.

It must be remembered, too, that more than 400,000 residential heat pumps arrive at prime replacement age each year. We don't think the replacement percentage is nearly so high for commercial heat pumps.

Of the 91,688 commercial heat pumps we believe were shipped in 1991, a total of 73,350 units (80%) went into new construction; 18,338 units were replacements.

Furnaces

Of the 2,056,670 residential gas furnaces shipped in 1991, we estimate that 598,900 (29.1%) went into new single- and multi-family homes, 300,000 were conversions from other fuels, and 1,157,770 (56.3%) were replacements.

This represents a 6.2% increase over the 1,089,365 replacement

(Next Page, Please)

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Homeowner.

Circle 12

WHOLESALERS

There are some encouraging aspects for the wholesaling business in 1992, such as new refrigerants, recovery-recycling machines, and other new products that add sales and growth opportunities, says Bob Bradford, president of the Air-conditioning and Refrigeration Wholesalers (ARW).

"For most firms, however, this year will probably be only marginally better than 1991," says Bradford. "Not great news, maybe — but certainly better than no growth at all."

ARW no longer conducts its annual wholesale sales forecast. In its place, we have asked its president to comment on past performance and to take a look at the year ahead. Bradford's comments:

"Concerning my expectations for this industry in 1992, I've not been particularly enthusiastic — especially with respect to the first half of the year. Typically, I believe that an emergence from the recession isn't likely to occur until sometime late in 1992 or, perhaps, even 1993.

"However, with some of the national statistics being reported for January and February, it's possible we're seeing some very early signs of a modest recovery.

"For example, national figures

REPLACEMENT MARKET

(Continued from Preceding Page)

units we believe were shipped in 1990.

These figures could be distorted by the year-end surge to produce sub-minimum efficiency furnaces prior to the mandatory federal minimums that took effect Jan. 1. If this surge amounted to 150,000 units, then the replacement market was flat.

A new market — the replacement of furnaces in good working order for reasons of efficiency — grew up in the past decade but, in recent years, has leveled off. Still, condensing furnaces with AFUEs (annual fuel utilization efficiencies) of 88% or more accounted for 20.5% of shipments last year, a 23.8% gain over the previous year's performance.

Of the 131,245 residential oil furnaces shipped last year, we estimate that 22,300 (17%) went into new homes, 9,540 were conversions from other fuels, and 99,405 units (75.7%) were replacement furnaces.

The number of oil furnace replacements in 1991 was almost the same as for the previous year. Both represent a substantial drop from the 162,790 replacements in 1986 and 136,480 replacement units as late as 1989.

The prime reason for the shrinking market for oil furnaces has been the decline of housing activity in the Northeast, oil's prime market. Housing starts in the Northeast have dropped by 61.5% since 1986, and the sales of existing homes also have declined sharply as property values tumbled.

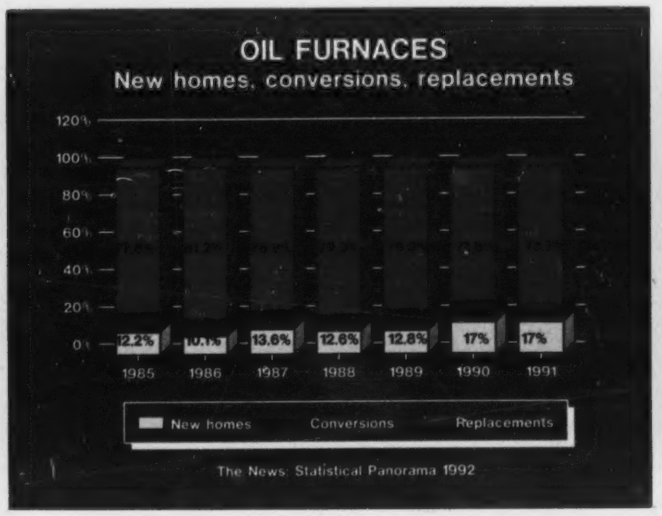
It might also be noted that 381,000 replacement oil burners were sold in 1991. Although this represents a 5.7% decline from the 404,000 replacement burners sold in 1990, it still represents a substantial market for contractors.

Boilers

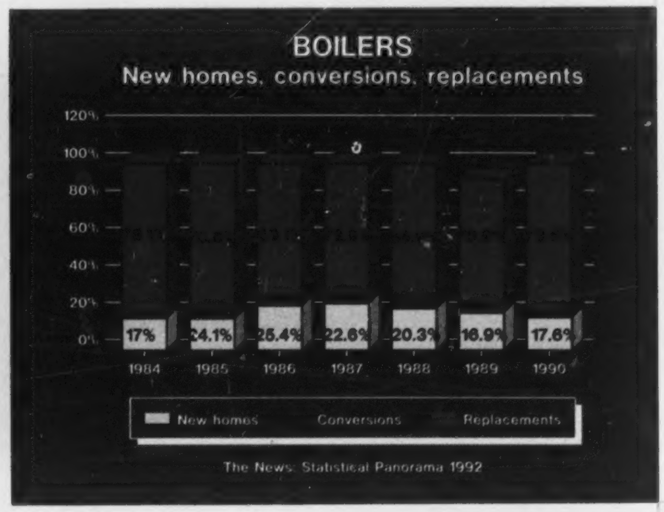
Of the 296,234 residential boilers shipped in 1991, we estimate that only 52,500 units (17.6%) went into new single- and multi-family homes, and 8,500 were conversions from other fuels.

The other 235,534 boilers, or 79.5% of the total, were replacements. That represents a 9.3% drop from the 259,637 replacement boilers shipped in 1990, but still is a strong showing given the condition of the Northeast housing market.

It should also be noted that The Hydronics Institute (HI) holds many contractor schools that, in addition to teaching the technical side of residential and commercial applications, also teaches contractors how to market hydronic systems.



The News: Statistical Panorama 1992



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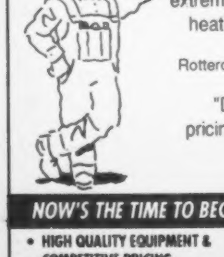
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Circle 28

INTERNATIONAL

A moderate drop in imports and a solid gain in United States exports spelled yet another increase in the industry's positive balance of trade in 1991. And, at nearly $1.5 billion, it was within shouting distance of the record $1.8 billion trade surplus recorded in 1981.

Again in 1991, half of the imports were in two categories — $715.8 million worth of compressors and $493.4 million worth of room air conditioners. Both were down from 1990 and were offset, in part, by U.S. exports of $427.5 million worth of compressors and $80.2 million worth of room air conditioners.

According to the Department of Commerce, U.S. exports of refrigeration and air conditioning equipment and components in 1991 totaled $3,619,334,000, or 10.8% more than the 1990 total of $3,265,359,000.

U.S. imports last year totaled $2,144,754,000, a decline of 6.9% from the $2,302,637,000 recorded in the previous year. The 1991 positive balance of trade, at $1,474,580,000, increased by 53.2% from the year-previous positive trade balance of $962,722,000.

Imports last year represented 59.3% of exports, down significantly from the 70.5% ratio recorded in 1990. In 1981, total imports of $273.8 million represented only 13.2% of exports.

Imports of compressors, although still substantial, were down in 1991 for the second year in a row. The total of 13.7 million compressors imported into the U.S. last year represented a 13.8% decline from the 15.9 million units imported in 1990. The U.S. imported 17.1 million compressors in 1989.

Room air conditioner imports in 1991, at 493,430 units, were down a whopping 45% from the previous year's total of 897,284 units and reflected the decline in the domestic room unit market. Room unit imports in 1983 totaled 98,000 units and, by 1988, had climbed to 1,087,875 units. Room unit exports in 1991 totaled 248,394 units, down 17.9% from the 302,530 room units exported in 1990.

There are many reasons for the strong emphasis on imported equipment and components. In addition to foreign companies seeking to initiate or expand U.S. market opportunities, two U.S. compressor manufacturers and a pair of room unit manufacturers have moved part or all of their production offshore so they can better compete in world markets.

Although the value of the dollar in relation to major world currencies continues to fluctuate, it

(Page 43, Please)

WHOLESALERS

for new orders reported by manufacturers in January rose at a seasonally adjusted rate higher than last December. The government's leading economic indicators also climbed nearly a percentage point for the first month of 1992.

"In addition, a February employment report showed a surprising gain in the total number of new jobs, although it must be quickly noted that unemployment itself rose to a new recent high of 7.3%.

"Our industry doesn't exist in a vacuum. We are both part of, and affected by, these numbers. Housing starts, although still depressed by 1980s' standards, are up. Also, the recent low interest rates have helped construction generally. They have also put more spendable dollars in the hands of consumers and others who have refinanced homes and other debt.

"For all of these reasons, we may well be seeing an end to the recession sooner rather than later. But most economists indicate that we're likely to crawl rather than bound out of this one. And, based on what I'm seeing, I'm inclined to agree."

NHAW perspective

Members of the Northamerican Heating and Airconditioning Wholesalers Association (NHAW) reported an overall median sales gain of 1.62% for 1991. But, as has been the case for the past three years, variations between geographic regions continue to be extreme.

To add some perspective, sales in 1990 showed a modest median decline of 0.1%, but down sharply from the increases of 12% in 1988 and 11.24% in 1989.

NHAW relies more heavily on medians (the number in the middle when individual reports are arranged from low to high) than on averages (the arithmetic mean of all results).

To avoid confusion, we'll stick to medians even though both averages and medians are included in the organization's reports.

Again, there was wide disparity between regions. For U.S. firms, they ranged from a median decline of 9.16% for Region 10 (California, Nevada, Arizona, and Hawaii), to a median increase of 14.75% for Region 12 (Idaho, Alaska, Oregon, and Washington).

Region 4 (Ohio and Michigan) reported a median gain of 11.48% for 1991. This follows a median decline of 3.8% in the previous year.

Surprisingly, the beleaguered Northeast Region 1 (Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island) reported a median gain of 6.3%. Neighboring Region 2 (New York, New Jersey, and Pennsylvania), however, reported a median decline of 2%.

Gains were reported in three other regions.

In Region 8 (Oklahoma, Arkansas, Louisiana, and Texas) the median gain was 8.79%. In Region 5 (Indiana, Illinois, and Wisconsin) the gain was 5.49%. And in Region 6 (Minnesota, Iowa, Nebraska, Missouri, Kansas, North and South Dakota), the median gain was only 0.99%.

A median sales loss of 2.24% was reported by wholesalers in Region 7 (Mississippi, Alabama, Georgia, South Carolina, Florida, and Puerto Rico). And in Region 3 (Delaware, Maryland, West Virginia, Virginia, North Carolina, Kentucky, Tennessee, and D.C.), the median decline was only 1.8%.

Canadian NHAW members posted a median sales decline of 6.71% in a market where equipment sales declined by several times' that amount. Here, again, there were sharp contrasts. Performance ranged from a median loss of 19% to a median gain of 9.8%.

In terms of firm size, those with annual sales volumes of less than $10 million had positive results in 1991. Those in the $10 million to $20 million annual sales range did less well, but median losses were less than 2%. The largest firms, those with annual sales volumes of $20 million or more, did best. They reported a median sales gain last year of 7.68%.

1992 forecast

Looking ahead, NHAW provides a quarter-by-quarter comparison of total sales — nationally and by region — compared to the identical quarter in the previous year.

As can be seen in the accompanying charts, the North American outlook is for a median gain of 3.5% this year. Sales are expected to be up 4% in the first quarter, down 2% in the second, and up 6% in the third and fourth quarters.

The forecast was prepared by William A. Spooner and Associates, Columbus, Ohio. It relates data supplied by NHAW members with the UCLA (University of California-Los Angeles) national business forecast, monthly sales trends, and residential and non-residential indicators.

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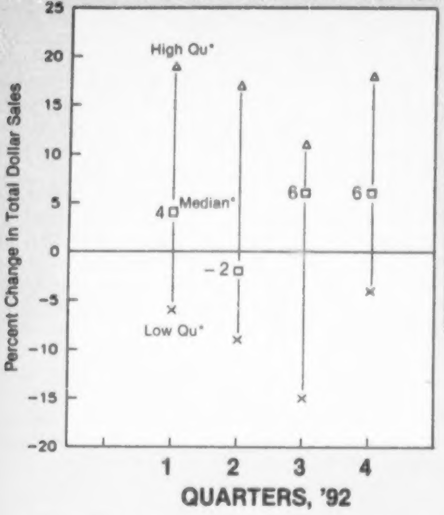
Circle 10

NHAW regional forecasts

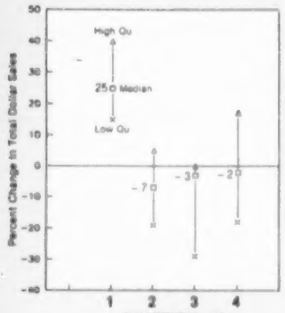
REGIONALITY was again prevalent in these forecasts supplied by the Northamerican Heating and Airconditioning Wholesalers Association (NHAW). They depict the expectations of the upper quartile, lower quartile, and median of all reporting wholesalers in that region.

NORTH AMERICA (All Regions) FORECAST
(When Compared To Identical Quarter In Previous Year — 1st Qtr. to 1st Qtr; 2nd Qtr. to 2nd Qtr., etc.)



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

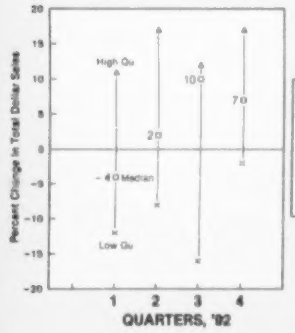
Medians
4th qtr '91 — ahead 3%
3rd qtr '91 — ahead 1%
2nd qtr '91 — was off −6%
1st qtr '91 — was off −1%



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — ahead 18%
3rd qtr '91 — was off −1%
2nd qtr '91 — was off −14%
1st qtr '91 — was off −14%

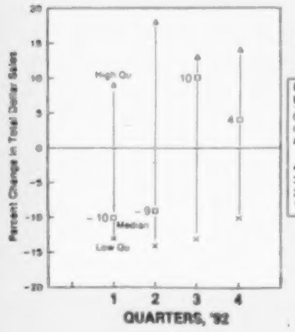
REGION 1
Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — ahead 7%
3rd qtr '91 — ahead 10%
2nd qtr '91 — ahead 2%
1st qtr '91 — was off −4%

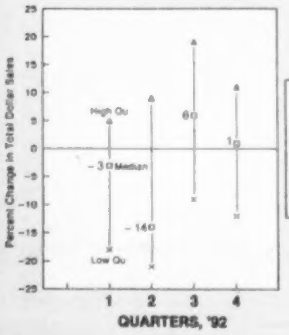
REGION 2
New York, New Jersey, and Pennsylvania



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — ahead 2%
3rd qtr '91 — even 0%
2nd qtr '91 — was off −15%
1st qtr '91 — was off −7%

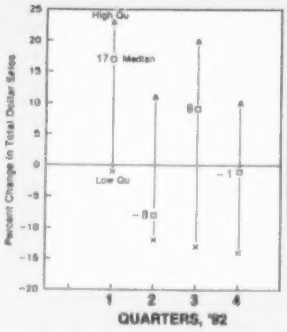
REGION 3
Delaware, Maryland, West Virginia, North Carolina, Virginia, Kentucky, Tennessee, and Washington, D.C.



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year earlier)

Medians
4th qtr '91 — ahead 10%
3rd qtr '91 — ahead 4%
2nd qtr '91 — was off −5%
1st qtr '91 — even 0%

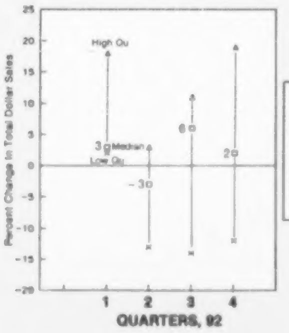
REGION 4
Ohio and Michigan



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — ahead 6%
3rd qtr '91 — ahead 5%
2nd qtr '91 — was off −2%
1st qtr '91 — ahead 6%

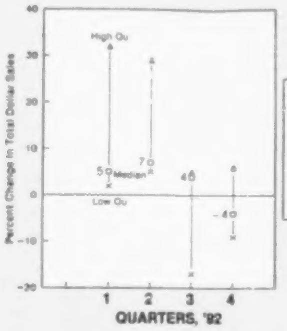
REGION 5
Indiana, Illinois, and Wisconsin



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — ahead 5%
3rd qtr '91 — ahead 7%
2nd qtr '91 — ahead 2%
1st qtr '91 — ahead 2%

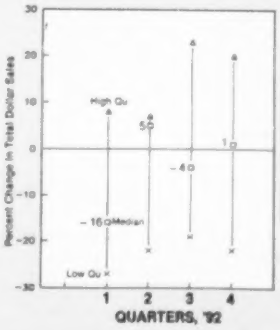
REGION 6
Minnesota, Iowa, North Dakota, Kansas, South Dakota, and Nebraska



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — was off −3%
3rd qtr '91 — was off −3%
2nd qtr '91 — was off −12%
1st qtr '91 — was off −3%

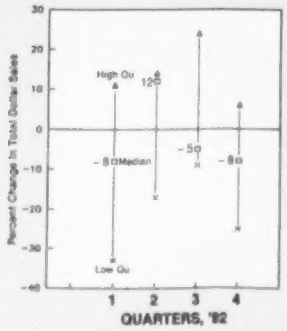
REGION 7
Mississippi, Alabama, Georgia, South Carolina, Florida, and Puerto Rico



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — ahead 15%
3rd qtr '91 — ahead 6%
2nd qtr '91 — ahead 18%
1st qtr '91 — ahead 4%

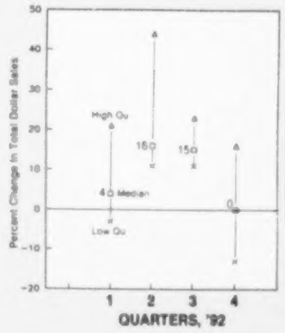
REGION 8
Oklahoma, Arkansas, Louisiana, and Texas



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — ahead 7%
3rd qtr '91 — ahead 4%
2nd qtr '91 — ahead 19%
1st qtr '91 — ahead 7%

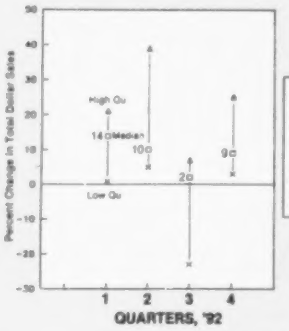
REGION 9
Montana, Wyoming, Colorado, New Mexico, and Utah



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — was off −4%
3rd qtr '91 — was off −14%
2nd qtr '91 — was off −13%
1st qtr '91 — ahead 4%

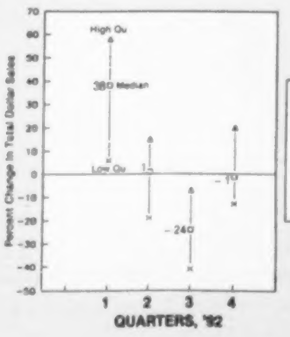
REGION 10
California, Arizona, Nevada, and Hawaii



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — was off −6%
3rd qtr '91 — was off −4%
2nd qtr '91 — was off −16%
1st qtr '91 — was off −8%

REGION 11
Canada



Reminders of Previous Performance:
(Most recently completed quarters as compared to a year-earlier)

Medians
4th qtr '91 — ahead 12%
3rd qtr '91 — ahead 17%
2nd qtr '91 — ahead 25%
1st qtr '91 — ahead 21%

REGION 12
Idaho, Alaska, Oregon, and Washington

(Continued from Page 41)

remains as a positive force. It has had some effect on the Japanese, who have built several plants in the U.S. The Japanese share of U.S. imports in 1991 was 42.7%, up slightly from 39.7% in the previous year. It was 49% in 1987.

Free trade

The U.S. and Canada are entering the fourth year of a 1988 free trade agreement that, over a 10-year period, will remove tariffs on air conditioning, heating, and refrigeration equipment. Canada continues to be the best customer for U.S. exports but, so far, has resisted attempts by U.S. manufacturers to eliminate all tariffs immediately.

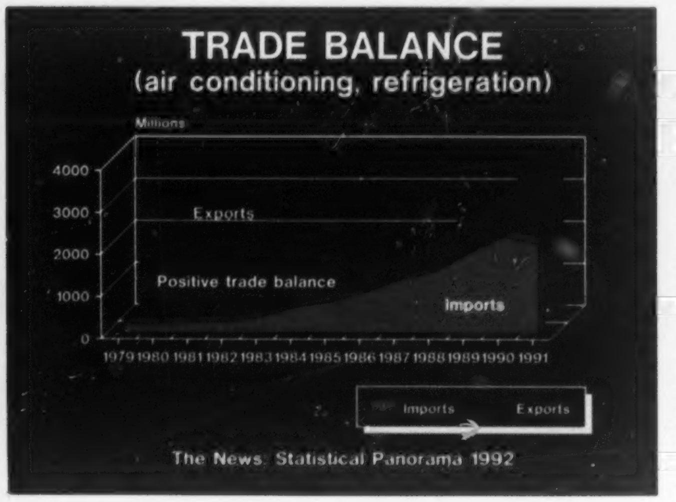
A Mexican free trade agreement with the U.S. and Canada is being negotiated. Industry equipment now faces a 15% to 20% duty when entering Mexico. In 1991, the U.S. exported $559 million worth of hvacr equipment and components to Mexico and imported $192 million worth.

It would appear that the European Economic Community's plans to remove all tariff and non-tariff barriers to trade within the 12-nation group in 1992 are running behind schedule. It promises to be an uneven introduction, but even those factors will not be known until summer.

Meanwhile, the task of developing common standards affecting the hvacr industry is progressing — but far from complete. U.S. trade associations and technical societies have been actively assisting in the development of standards and test methods.

Many U.S. companies have been established in Europe for many years. The prospect of easier trading in Western Europe has been given an added boost by the unification of Germany and the independence of many nations in Eastern Europe. The reorganization of states within the former Soviet union also promises new opportunities when currency and credit problems have been resolved.

Although not expected to develop overnight, markets in Eastern Europe are expected to develop exponentially over the next decade. The problem is not need. It's the means of payment that will take time to develop.



Exports

In terms of products exported from the United States, the Department of Commerce prepares a country-by-country breakdown for most of the product categories contained in the SIC (standard industrial category) 3585 classification.

Although we don't have the space to list the complete breakdown, a feel for the top export markets in 1991 can be gained by looking for key products and top customer countries.

The following breakdown provides the 1991 total for each category and the total for 1990 in parentheses:

Compressors of 3 hp or less — 2,097,467 units (1,440,485 in 1990); Saudi Arabia 466,817; South Korea 280,124; Japan 215,515; Mexico 162,698; Taiwan 121,666; Venezuela 105,811; Italy 94,770; Hong Kong 91,905; Egypt 72,731; and Canada 59,150.

Compressors from 3 to 10 hp — 246,157 units (171,725 in 1990); Thailand 43,969; South Korea 34,079; Venezuela 25,654; Hong Kong 22,070; Malaysia 18,128; Mexico 13,184; Australia 10,157; and Argentina 8,145.

Compressors over 10 hp — 110,835 units (149,186 in 1990); Canada 60,407; France 10,734; Mexico 8,826; Taiwan 4,757; Malaysia 3,813; Thailand 2,496; Britain 2,231; and Australia 2,123.

Screw compressors — 13,686 units (4,061 in 1990); Nigeria 11,503; Mexico 547; Canada 272; and Germany 231.

Ammonia compressors — 97,026 units (89,278 in 1990); Canada 87,515; Venezuela 2,590; Mexico 2,303; Nigeria 1,535; and South Korea 517.

Auto and truck refrigeration and air conditioning compressors — 193,354 units (203,652 in 1990); Mexico 44,839; South Korea 29,401; Argentina 24,724; Canada 12,142; Germany 10,407; Britain 9,521; Italy 9,425; Hong Kong 8,316; France 7,613; Saudi Arabia 6,212; and Australia 5,025.

Parts for refrigeration and air conditioning compressors — $65,494,000 ($77,309,000 in 1990); Belgium $12,844,000; Canada $12,673,000; Saudi Arabia $4,420,000; South Korea $3,206,000; Germany $3,035,000; Mexico $2,781,000; Singapore $2,084,000; France $2,014,000; and India $1,945,000.

Room air conditioners under 10,000 Btuh — 108,531 units (126,482 in 1990); Canada 40,894; Mexico 13,792; Taiwan 9,936; Belgium 9,333; Sweden 2,835; Panama 2,682; Bahamas 2,386; and Israel 1,817.

Room air conditioners from 10,000 to 17,000 Btuh — 48,878 units (187,062 in 1990); Mexico 15,748; Taiwan 7,178; Hong Kong 3,485; Argentina 2,261; Spain 1,924; Panama 1,325; Djibouti 1,276; and Nigeria 1,188.

Room air conditioners over 17,000 Btuh — 90,985 units (88,986 in 1990); United Arab Emirates 20,217; Mexico 11,579; Taiwan 8,799; Saudi Arabia 5,374; Ecuador 1,477; Turkey 1,293; Canada 1,183; and Oman 1,105.

Self-contained heat pumps — 63,078 units (73,463 in 1990); Turkey 16,243; Canada 14,701; Germany 5,469; Britain 3,377; Chile 3,215; Saudi Arabia 2,512; and Venezuela 2,084.

Split-system heat pumps — 78,124 units (63,243 in 1990); Canada 25,313; Mexico 11,720; Greece 4,169; South Korea 2,564; Nigeria 2,209; Venezuela 1,923; Jamaica 1,660; and Germany 1,298.

Self-contained air conditioners — 14,673 units (33,385 in 1990); Saudi Arabia 3,613; Mexico 2,113; Canada 1,393; Britain 989; Greece 568; United Arab Emirates 552; and Honduras 549.

Split-system air conditioners — 7,911 units (93,815 in 1990); Saudi Arabia 2,261; Canada 944; Britain 636; Mexico 635; Taiwan 610; and United Arab Emirates 533.

All-year heating-cooling packages — 25,528 units (25,431 in 1990); Canada 8,400; Saudi Arabia 2,189; Hong Kong 1,551; Japan 1,089; France 946; Mexico 925; and Kuwait 872.

Room fancoil units — 25,103 units (25,346 in 1990); United Arab Emirates 4,144; Singapore 2,517; Turkey 2,214; Canada 1,934; Hong Kong 1,629; Egypt 1,302; Taiwan 990; and Chile 772.

Central station air handlers — 4,686 units (3,563 in 1990); Saudi Arabia 712; Ecuador 544; Egypt 383; Taiwan 352; Canada 345; Mexico 342; and Bahamas 235.

Room terminal units — 20,010 units (28,508 in 1990); Hong Kong 3,511; Mexico 2,163; Israel 1,974; South Korea 1,402; Saudi Arabia 1,384; Germany 1,378; France 1,243; and Bahamas 1,212.

Condensing units 60,000 Btuh and under — 110,094 units (70,042 in 1990); Saudi Arabia 42,944; United Arab Emirates 20,051; Hong Kong 7,249; France 7,027; Germany 4,273; Japan 3,453; Kuwait 2,750; Bahrain 2,714; and Singapore 1,494.

Condensing units over 60,000 Btuh — 8,697 units (6,975 in 1990); Saudi Arabia 2,507; United Arab Emirates 1,665; Canada 891; Taiwan 576; Singapore 510; and Thailand 412.

Of the $740,761,000 in **air conditioning machinery parts** ($747,834,000 in 1990), Canada accounted for $385,881,000; Saudi Arabia $70,448,000; Mexico $38,322,000; South Korea $32,167,000; France $16,749,000; Germany $15,694,000; Britain $14,469,000; Japan $14,086,000; Venezuela $13,484,000; and Australia $10,810,000.

Freezer display cases — 21,727 units (21,388 in 1990); Netherlands 4,052; Canada 3,968; United Arab Emirates 3,103; Mexico 1,283; Japan 1,015; Lebanon 650; New Zealand 579; Panama 481; Australia 473; and Greece 462.

Refrigerated display cases — 78,034 units (71,645 in 1990); South Korea 18,899; Mexico 10,601; Canada 8,823; Britain 5,214; Japan 4,088; Taiwan 3,030; France 2,769; Saudi Arabia 1,763; Spain 1,690; and Suriname 1,446.

Ice-making machines — 33,571 units (27,473 in 1990); Canada 6,034; Taiwan 2,438; South Korea 2,385; Saudi Arabia 2,217; Mexico 2,097; France 1,957; United Arab Emirates 1,805; Singapore 1,800; Venezuela 1,790; and Hong Kong 1,464.

Drinking water coolers — 163,975 units (160,397 in 1990); Canada 63,108; Saudi Arabia 18,740; Israel 18,269; Hong Kong 9,499; Britain 9,443; Japan 6,502; Singapore 5,563; France 4,570; Denmark 3,403; and South Korea 2,657.

Open-type centrifugal chillers — 614 units (428 in 1990); Taiwan 141; Britain 129; Canada 113; Germany 101; Australia 49; and Saudi Arabia 44.

Hermetic centrifugal chillers — 7,181 units (1,602 in 1990); Taiwan 1,670; France 951; Thailand 932; Singapore 742; Hong Kong 619; Malaysia 515; and Canada 273.

Absorption liquid chillers — 1,893 units (702 in 1990); France 674; Mexico 279; Germany 172; Bahamas 156; and Iran 149.

Reciprocating liquid chillers — 3,871 units (2291 in 1990); Canada 370; Germany 292; Hong Kong 245; Singapore 242; United Arab Emirates 224; Japan 185; Indonesia 182; Malaysia 169; and Egypt 155.

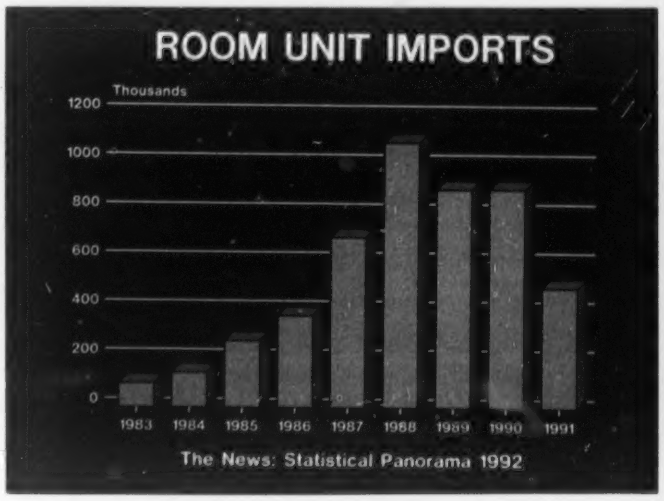
Refrigerator and freezer parts — $224,702,000 ($148,658,000 in 1990); Mexico $40,604,000; Ireland $27,639,000; Canada $22,624,000; Japan $12,485,000; Britain $11,595,000; Saudi Arabia $11,345,000; Australia $5,482,000; Germany $5,293,000; and Brazil $4,582,000.

Imports

According to the Department of Commerce, nine nations accounted for $1.819 billion, or 84.9%, of the $2,144,754,000 worth of air conditioning and refrigeration equipment and components imported into the U.S. in 1991.

Of the total 1991 imports:

- **$764.4 million came from Japan,** down 16.4% from $914.6 million in 1990, which mostly included 805,385 compressors of less than 0.25 hp, 3,150 screw compressors, 4,227,345 motor vehicle compressors, 616,035 compressors of 0.25 to 1 hp, 491,361 compressors of from 1 to 3 hp, 45,803 compressors of from 3 to 10 hp, 1,453 compressors over 10 hp, 45 ammonia compressors, 17,839 room air conditioners, 14,517 self-contained heat pumps, 294 other heat pumps, 7,238 all-year split-system air conditioners, 4,550 all-year air conditioners, 4,057 evaporator coils with refrigeration unit, 1,422 room fancoils, 720 dehumidifiers, 17,805 other air conditioners, 10,545 auto air conditioners, 21,571 condensing units, 153,076 heat exchangers, $110 million in auto air conditioning parts, 4,433 ice makers, and $12.6 million in refrigerator-freezer parts.
- **$260.5 million came from Mexico**, up 54.5% from $168.6 million in 1990, which mostly included 2,115 compressors of less than 0.25 hp, 76,993 motor vehicle compressors, 145 compressors of 0.25 to 1 hp, 12,746 room air conditioners, 503 self-contained heat pumps, 230 other heat pumps, 8,440 all-year air conditioners, 245,861 evaporator coils with refrigeration unit, 2,035 condensing units, 12,393 air conditioners without compressors, $40.5 million in auto air conditioner parts, 8,730 refrigerator-freezers, 60,149 upright freezers, 606,933 refrigeration condensing units, and $23.3 million in refrigerator-freezer parts.
- **$217.3 million came from Canada,** down 1.6% from $220.9 million in 1990, which mostly included 285,346 compressors of less than 0.25 hp, 42 screw compressors, 352 motor vehicle compressors, 346,865 compressors of 0.25 to 1 hp, 7,382 room air conditioners, 33,225 self-contained heat pumps, 4,827 other heat pumps,



(Page 46, Please)

INTERNATIONAL

(Continued from Page 43)

1,127 evaporator coils with refrigeration unit, 12 central station air handlers, 6,344 dehumidifiers, 4,294 other air conditioners, 587 auto air conditioners, 221 heat exchangers, 1,977 air conditioners without compressors, $17 million in auto air conditioning parts, 1,299 refrigerator-freezers, 162,419 chest freezers, 159 display freezers, 3,997 refrigerated display cases, and $12.4 million in refrigerator-freezer parts.

- **$156.4 million came from Singapore,** down 11.3% from $176.5 million in 1990, which mostly included 1,505,606 compressors of less than 0.25 hp, 16 screw compressors, 1,301,429 compressors of 0.25 to 1 hp, 34,305 compressors of 1 to 3 hp, 44 compressors of 3 to 10 hp, 607 compressors over 10 hp, 83,389 room air conditioners, 53,388 self-contained heat pumps, 60 all-year air conditioners, 486 evaporator coils with refrigeration unit, 79 room fancoils, 438 refrigerator-freezers, and $9.5 million in refrigerator-freezer parts.

- **$132.3 million came from Germany,** down 3.5% from $137 million in 1990, which mostly included 90 compressors of less than 0.25 hp, 780 screw compressors, 3,122 motor vehicle compressors, 494,724 compressors of 0.25 to 1 hp, 259 compressors of 3 to 10 hp, 667 compressors over 10 hp, 854 room air conditioners, 15 heat pumps, 253 air conditioners, 1,360 auto air conditioners, 3,677 condensing units, 1,195 heat exchangers, $3.8 million in auto air conditioner parts, 1,793 refrigerator-freezers, 245 chest-type freezers, 95 refrigerated display cases, 43 absorption chillers, 41 refrigeration condensing units, and $1.5 million in refrigerator-freezer parts.

- **$113.1 million came from Brazil,** down 21.2% from $143.6% in 1990, which mostly included 2,020,076 compressors of less than 0.25 hp, 3,749 screw compressors, 140 motor vehicle compressors, 564,679 compressors of 0.25 to 1 hp, 7,041 compressors of 1 to 3 hp, 8,605 compressors of 3 to 10 hp, 415 compressors over 10 hp, 78,511 room air conditioners, 5,149 heat pumps, 71 other air conditioners, $339,000 in auto air conditioner parts, and 308 refrigerator-freezers.

- **$76.4 million came from Malaysia,** down 15.3% from $90.2 million in 1990, which mostly included 4,457 compressors of less than 0.25 hp, 200 screw compressors, 52,619 compressors of 0.25 to 1 hp, 266,260 compressors of 1 to 3 hp, 172,078 room air conditioners, 595 other air conditioners, 1,683 air conditioners without compressors, and $284,000 in refrigerator-freezer parts.

- **$49.7 million from Italy,** down 34% from $75.3 million in 1990, which mostly included 336,828 compressors of less than 0.25 hp, 722 screw compressors, 66 motor vehicle compressors, 45,436 compressors of 0.25 to 1 hp, 187 compressors of 1 to 3 hp, 12,381 compressors over 10 hp, 2,017 ammonia compressors, 1,781 room air conditioners, seven all-year air conditioners, 10 central station air handlers, 36 other air conditioners, 745 auto air conditioners, 35 condensing units, $375,000 in auto air conditioner parts, 1,139 chest-type freezers, 593 freezer display cases, 238 refrigerated display cases, 1,341 ice makers, and $3 million in refrigerator-freezer parts.

- **$49.5 million from South Korea,** down 41.7% from $85 million in 1990, which mostly included 50,411 compressors of less than 0.25 hp, 2,700 screw compressors, 3,891 motor vehicle compressors, 11,073 compressors of 0.25 to 1 hp, 6,250 compressors of 1 to 3 hp, 3,444 compressors over 10 hp, 80,335 room air conditioners, 162 heat pumps, six all-year air conditioners, 68 self-contained air conditioners, 240 evaporator coils with refrigeration unit, 109,648 dehumidifiers, 24,999 other air conditioners, 1,217 auto air conditioners, 2,968 condensing units, $178,000 in auto air conditioner parts, 6,216 refrigerator-freezers, 395 chest-type freezers, 3,026 upright freezers, 205 display freezers, 437 refrigeration condensing units, and $1.1 million in refrigerator-freezer parts.

ASSOCIATION CALENDAR

APRIL

Energy, Air Conditioning & Environmental Technology '92, April 1-8, Hannover Fairgrounds, Hannover, Germany.

1992 Automated Manufacturing Exhibition and Conference, April 7-9, Palmetto International Exposition Center, Greenville, S.C.

Air Movement and Control Association Mid-Year Meeting, April 25-28, Orlando Peabody, Orlando, Fla.

American Consulting Engineers Council's Annual Convention, April 26-30, Fairmont Hotel, Chicago, Ill.

International Association of Refrigerated Warehouses' 101st Annual Convention and Trade Show, April 26-30, The Greenbrier, White Sulphur Springs, W. Va.

Corrosion '92, National Association of Corrosion Engineers Annual Convention, April 27-May 1, Opryland Hotel, Nashville, Tenn.

National Appliance Parts Suppliers Association Convention and Trade Show, April 27-May 2, Marriott Hotel, Eaton Centre, Toronto, Canada.

FABTECH East Exposition and Conference, April 28-30, Raritan Convention Center, Edison, N.J.

First Annual Indoor Air Quality Conference & Exposition, April 29-May 2, Tampa Convention Center, Tampa, Fla.

MAY

1992 Food Marketing Institute's Annual Supermarket Industry Convention and Educational Exposition, May 3-6, McCormick Place, Chicago, Ill.

American Gas Association's Distribution/Transmission Conference, May 4-6, Westin Crown and Hyatt Regency, Kansas City, Mo.

National Board of Boiler and Pressure Vessel Inspector's General Meeting, May 4-8, San Antonio Marriott River Center, San Antonio, Texas.

Gas Appliance Manufacturers Association's Annual Meeting, May 10-13, Ritz Carlton Resort, Naples, Fla.

National Water Well Association's 6th National Outdoor Action Conference and Exposition, May 11-13, Riviera Hotel, Las Vegas, Nev.

Association of Home Appliance Manufacturers' 1992 Annual Member Meeting, May 14-15, Fairmont Hotel, Chicago, Ill.

73rd Annual National Restaurant Association's Restaurant, Hotel-Motel Show, May 14-20, McCormick Place, Chicago, Ill.

60th Annual Edison Electric Institute Convention/Expo '92, May 31-June 3, Hyatt Regency Columbus, Columbus, Ohio.

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The Air Conditioning, Heating and Refrigeration NEWS

Postcard to
the President
— see page 8

NEWSPAPER

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This Week

Compressor update

Why compressors fail: Oil dilution during the off cycle 3

Efficiency, reliability add to popularity of scrolls 20

Reciprocating compressors adapt to efficiency demands 22

"Compound Cooling" unit promotes R-22 efficiency 26

Contracting ideas

Subcontracting can lead to problems with the IRS.......... 23

Wallace Lee increases profits by using just one supplier 24

"Idea" session at ACCA offers profit-building tips.......... 25

Texas inventor finds niche in reclaiming refrigerants 27

STATISTICAL PANORAMA

Housing and Construction 10

Labor and bargaining 12

Fuels and energy 14

Also inside:
EPA clarifies CFC program status (page 17).

Regular features

Editorial .... 18 Advertisers 29
Patents .... 30 Classifieds 28-29
What's New .... 31 Dope............... 18-19

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CONTRACTORS WILL BE HELD LIABLE FOR TECHS WHO LEAK REFRIGERANTS

by Thomas A. Mahoney

WASHINGTON — Contractors whose service technicians violate the July 1 no-venting rule for CFC and HCFC refrigerants will find themselves liable for potentially steep fines, as will the owners of the air conditioning and refrigeration equipment.

An Environmental Protection Agency (EPA) official said the agency will go after anyone who would feel the sting for violating the no-venting rule, which takes effect July 1.

"What we want to do, quite frankly, is to make as many people as possible liable, just to put on the enforcement pressure," said Craig Haas, an EPA enforcement official.

In expanding liability, EPA wants to ensure that "everybody has an incentive to play right," he said. "We wouldn't want a contractor to be able to say, 'It was just that one technician [who violated the rule].' "

After a series of meetings with industry representatives, EPA expects to send its proposed recycling rules to the White House for review this month.

In a phone interview with *The News*, Haas summarized remarks he made to a contractor-sponsored meeting last month in North Carolina.

The agency is planning for a "significant increase in enforcement personnel," he said.

Although the agency will not be 100% staffed with inspectors by July 1, "We will have them ready. We will have the capacity to respond to significant tips."

Citing the Clean Air Act amendments which underlie the proposed rule, Haas said:

- The maximum fine is $25,000 per day per violation. Each kilogram (kg) of CFC illegally imported or manufactured would be a separate violation. The same per-kg violation could apply to venting.
- After July 1, a leaky mechanical system is not, in itself, a violation. However, once it is serviced, any significant, intentional venting would make the parties involved liable.
- Depending on the severity of the offense, violators will face one of three courts: an EPA administrative court; a federal civil court; or a federal criminal court.
- Enforcement will be accomplished by EPA. "But the states could, if they express an interest, do inspections for us."
- "Field citations" will be issued to technicians who use non-certified recovery-recycling equipment. "It's like a traffic ticket," Haas said.
- To date, the agency has not "targeted" certain types of equipment — chillers, rooftops, etc. — for immediate inspection. "There will be a certain number of random inspections." Otherwise, inspections will based on "tips and suspicions of violations."

Regarding the payment of bounties for those who report intentional venting, EPA representatives have issued conflicting information.

During a local Air Conditioning Contractors of America conference in Lansing, Mich., a Region V EPA spokesperson said a $10,000 bounty would not be imposed.

The spokesperson said the proposed bounty was never more than a proposal. "Those who invest in the recovery equipment will probably turn in anyone who is breaking the law [anyway]," she said.

But the Washington EPA press office said the enforcement provision is part of the Clean Air Act, and that no decision has been made on whether it will be applied.

ACCA spells out formula to end industry skirmishes

HONOLULU — Consumers benefit most when all the entities that provide their comfort — contractors, wholesalers, manufacturers, and utilities — work together.

To put it mildly, that's not always the case.

However, while there have been continuing skirmishes among these four entities, no one has ever described how the whole thing *should* work. That is, until now.

A model document, introduced at the Air Conditioning Contractors of America's annual meeting by Honeywell's John Ehlen (chairman of ACCA's Associate Member Task Team), defines the best-case relationship — "partnering" — of each faction with the others.

Defined, for example, are the relationships between:

- Contractor-utility; utility-contractor;

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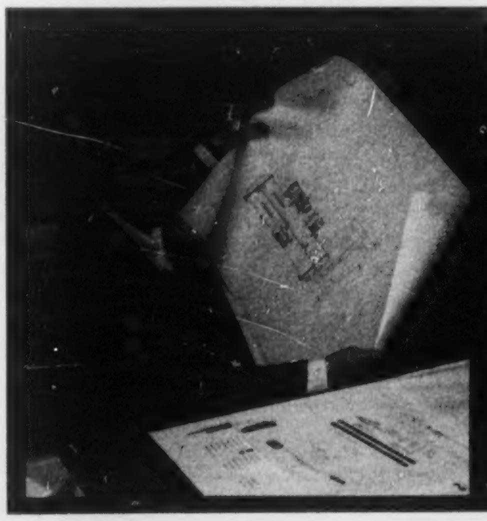


Details, details

FEATURED IN OUR "COOLING SHOWCASE" issue next week will be the step-by-step replacement of an old chiller with one using R-134a for a downtown Atlanta office building. Carlin O. Hodges, vice president service operations for Cherokee Heating and Air Conditioning, looks over plans that helped keep tenants from even knowing the work was underway.

Why compressors fail mechanically

(Continued from Page 3)

at all temperatures.

Sugar and water are miscible until the water gets saturated.

R-22 and R-502 are not miscible under all conditions. In the same vessel, they sometimes separate into two layers. The upper layer will be an oil-rich mixture of refrigerant and oil. The bottom will be a layer of refrigerant-rich mixture of oil and refrigerant.

This difference between R-12 and -502 and R-22 may surprise service technicians who are used to working with only R-12. In any event, the driving force to cause refrigerants to mix with oil in the compressor is the difference in pressure.

Even a solid such as steel can be melted and vaporized and, consequently, can have a vapor pressure chart. We're not very familiar with it, but it exists.

Oil has a vapor pressure system of its own. At 350°F, it has a vapor pressure of about 150 microns. At 70°, its vapor pressure is about 0.01 micron.

Now consider that the vapor pressure of R-22 at 70° is about 120 psig. Since 1 psig = 50,000 microns, 120 psig X 50,000 microns/lb = 6,000,000 microns of refrigerant pressure.

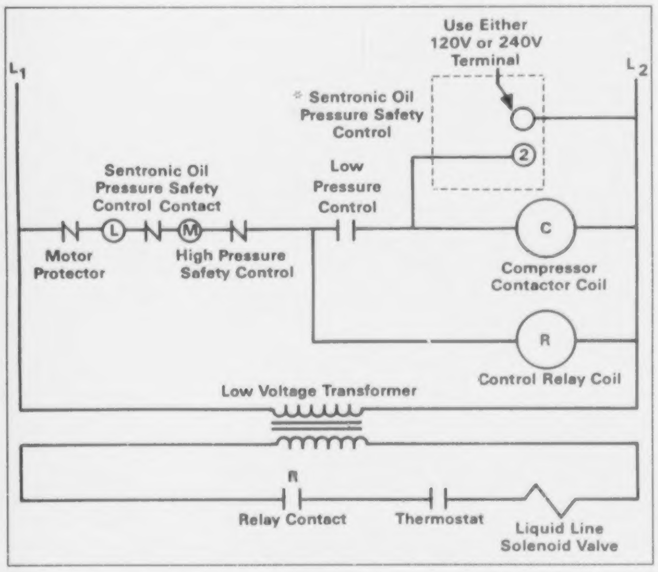
This is some pressure difference: 6,000,000 microns against 0.01 microns for the oil; you can see why the refrigerant moves to the oil so easily and rapidly.

Actually, the refrigerant moves more or less rapidly depending on the percentage of refrigerant in the oil. It moves very rapidly to pure oil, but as the oil becomes mixed with more refrigerant, the vapor pressure of the mixture raises, so that the differential pressure decreases and the migration rate decreases.

Increasing the oil temperature reduces the migration speed, while raising refrigerant temperature increases migration speed.

For example, an idle condensing unit outdoors in the sun is hot, while the evaporator coil indoors may be quite cool; migration is slow.

In cold weather, just the opposite is true. The unit with its oil in the compressor is cold and the evaporator is warm; migration is rapid.



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R
Relay Contact
Thermostat
Liquid Line Solenoid Valve

FIGURE 2 — Typical low voltage control circuit.
* May be conventional control.

Consider our previous article on flooding. Any flooding action causing cool liquid refrigerant to enter the compressor also causes the oil to cool and absorb more refrigerant.

Lubrication woes

Excess flooding causes poor lubrication of lower crankcase gears. In fact, as described in our previous article, the oil pump can pump a mixture of refrigerant and oil.

But as the mixture leaves the pump, the crankshaft friction boils off some of the liquid, leaving insufficient oil volume to lubricate the connecting rods and rear main bearings.

This results in an ever-increasing wear pattern developing as the mixture gets further from the pump.

The pump may cavitate from severe dilution because the "Freon" boils at the pump entrance blocking oil flow. This commonly causes what are called "nuisance trips" of the oil pressure safety switch.

The switch is warning of a problem when it trips; it should never be considered a nuisance trip. Any flooding or migration problem must be corrected or a premature compressor failure will occur.

A major problem with migration is that large quantities of liquid refrigerant may be stratified near pure liquid in the crankcase during the off cycle. Upon start-up, even a small drop in suction pressure causes a violent explosion of this refrigerant, which can clear oil and liquid out of the crankcase in a few seconds.

In addition, severe slugging may result. (This will be covered in a separate article.)

So, how can these problems be prevented?

Limit refrigerant charge

The first and most important criteria of design to stop excess dilution damage is to limit the refrigerant charge in the system.

If the refrigerant charge can be kept down to about two to three time's the oil charge (by weight), damage is unlikely to occur because the worst-possible mixture in the crankcase would be 75% refrigerant, 25% oil.

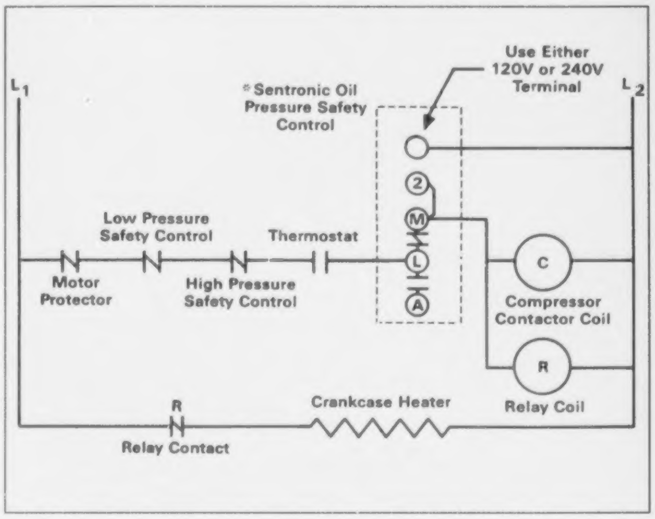
Small, self-contained systems usually can survive with this mixture. But central-station, two-piece systems, and almost any system with a liquid receiver, probably could not stay within this ratio.

To limit refrigerant charge, you could:

- Limit liquid line size;
- Eliminate receivers if possible;
- Keep the refrigerant charge as low as possible;
- Never overcharge a system;
- Use the smallest-practical lines and components; and
- Use crankcase heaters.

But remember, crankcase heaters have limitations. They must be kept to a reasonable low amperage to prevent oil carbonization and overheating.

The wattage is so low that in low ambient conditions (from 50° to 0°), they are of little value in outdoor applications. Also, refrigerant enters the oil rapidly, but heat drives it out slowly. Crankcase heaters must be on 12 to 24 hours to be effective.



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High Pressure Safety Control
C
Compressor Contactor Coil
R
Relay Coil
R
Crankcase Heater
Relay Contact

FIGURE 3 — Typical crankcase heater control circuit.
* May be conventional control.

Considered the best method to prevent migration is the use of a **pump-down system,** in which the cycle control opens and closes a liquid line solenoid valve.

When the cycle ends, the control closes the solenoid valve and allows the compressor to keep running, evacuating the evaporator, suction line, and compressor crankcase to a reasonable low pressure.

A low pressure switch turns the compressor off.

The reverse happens when the solenoid valve is reopened. Figures 1, 2, and 3 show one compressor manufacturer's ideas of typical pump down and crankcase heater wiring diagrams. (While a relay on the crankcase heater circuit is shown, most air conditioning systems can operate without this relay.)

Sometimes a relay is added to prevent recycling until the cycle control opens the solenoid valve. It is hoped that with this system, not enough liquid will seep through any leaking valves to do any harm.

I prefer to count on the valves not leaking and use the recycling pump-down system. Usually a combination of design and devices, such as crankcase heaters and pump-down systems, are used. Anything is helpful.

The next article will be on slugging, which can be caused by either flooding or migrating refrigerant.

Dick Snyder knows air conditioning and refrigeration equipment. He has studied equipment service, both as a technician and a manufacturer, and has taught service concepts to thousands of contractor and wholesaler personnel. He is currently associated with Young Supply Co., Detroit, and now writes exclusively for *The News*.

April 6, 1992
Vol. 185, No. 14, Serial No. 3287

The NEWS Air Conditioning, Heating and Refrigeration

Air Conditioning, Heating & Refrigeration News (ISSN 0002-2276) is published 52 times a year by Business News Publishing Co., P.O. Box 2600 (755 W. Big Beaver Rd., 48084), Troy, Mich. 48007. Telephone 313-362-3700, FAX 313-362-0317.

Subscription Rate: $63 per year in the U.S. (in California, please add 7.75% sales tax); $87.41 per year in Canada (includes postage and $4.41 GST); $143 per year all other countries, payable in U.S. funds.

Microfilms of The News are available from: University Microfilms, 300 N. Zeeb Rd., Ann Arbor, Mich. 48103.

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Second Class Postage Paid at Troy, Mich. and at additional mailing offices.

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HOUSING AND CONSTRUCTION

After braving its worst year since the end of World War II, the nation's housing industry is promising to pull the U.S. up from a lackluster end to the recession.

The lowest mortgage interest rates in nearly two decades and an upward stirring of consumer confidence are expected to overcome — at least, to some extent — a continuing builder loan credit crunch to produce a welcome 18% surge in new home starts this year.

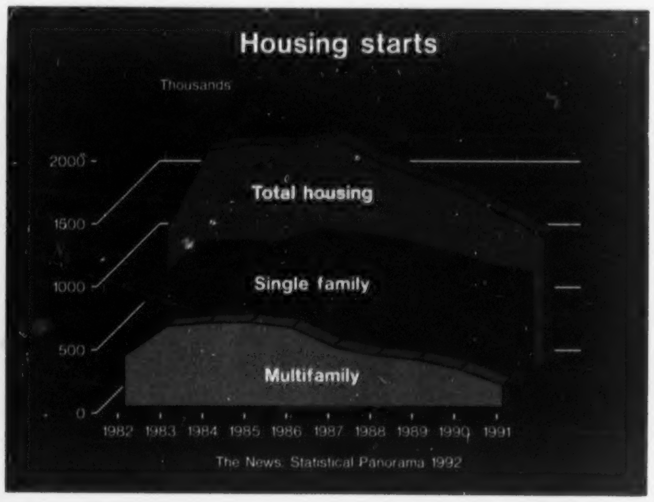
The forecast of 1,200,000 new home starts in 1992 does not include any election-year gimmicks. If they do occur, they'll probably be too little and too late. Home building, along with existing home sales and associated industries, accounts for about 20% of the nation's gross national product (gnp) and should be able to pull the economy out of the doldrums.

But, first, a look at what happened last year.

Total private housing starts in 1991 amounted to 1,014,700 units, down 14.9% from the 1,192,700 units started in the previous year. Last year's total was the latest in a steady decline of nearly 800,000 units since 1986, and was the lowest total since 1946.

Single-family home starts, where the trade-up segment is softening, totaled 841,600 units last year, a decline of 5.9% from the 894,800 single-family homes started in 1990. It was the second year in a row that single-family home construction has fallen below the 1-million mark since 1982.

Housing starts



The News: Statistical Panorama 1992

Multi-family starts in 1991 added up to a dismal 173,100 units, down 41.9% from the year-previous total of 297,900 units. This market, which recorded 626,000 starts in 1986, was hit by massive overbuilding in the mid-1980s, a vacancy rate still in the 11% range, and tight credit.

Again, in 1991, declines were registered in all four regions.

Housing starts in the Northeast, at 112,900 units in 1991, were down 14% from the 131,800 starts recorded in 1990. Last year's decline followed a 26.4% drop in 1990 and an almost free fall of 61.5% from the 1986 total of 293,500 units. The mini-boom of the years 1985 through 1987 has given way to falling property values and a virtual gridlock among buyers and sellers.

The smallest decline — 7.7% — came in the Midwest. The 1991 total of 233,800 starts was down from the year-previous total of 253,200 starts. Labeled the "rust belt" in years past because of difficulties in the manufacturing and agriculture industries, 1991 was the first year since 1986 that new home starts fell below 250,000 units. The drop since 1986 was 20.9%, the lowest of all regions.

New home starts in the South, which still accounts for nearly 41% of the total housing market, totaled 414,300 units in 1991, down 13.6% from the 479,300 new home starts recorded in 1990. In 1983, the South accounted for 55% of the nation's new home starts but, since 1986, starts in that region have declined by 43.5%.

Looking ahead, NAHB sees better times. It forecasts that total starts in 1993 will amount to 1,424,000 units and, in 1994, starts will total 1.598,000 units.

New home construction in the West, at 253,700 units in 1991, was down 22.9% from the year-previous total of 328,900 units. Hampered by high home prices and, within the last year, by tight credit, the West has dropped by 47.5% from the 1986 peak of 483,000 units.

A survey of home builders at the NAHB convention in late January revealed that consumer confidence still is their number one problem. It was followed by land cost and the difficulty in getting construction loans.

Consumer confidence is largely a localized problem that's obviously more pronounced in areas where there have been plant closings or significant layoffs. There were indications early in 1992 that consumer confidence is on the rise, if only slightly.

It appeared — at least from the point of view of sales — that consumers were sitting on their hands in the face of the lowest mortgage interest rates in nearly two decades.

Credit for ADC (acquisition-development-construction) loans has become a double-edged problem for builders. The collapse of many thrift institutions, where more than half of builders arranged for ADC financing, has reduced this source to about 30%.

Some 490 thrifts have been taken over by the federal government's Resolution Trust Corp. Some were merged or sold and 220 were held under RTC conservatorship or receivership. Some estimate it will take $200 billion to clean up the mess. Of the 2,945 thrift institutions before reform, 328 failed in 1989, 200 in 1990, and another 168 in 1991.

Commercial banks picked up much of the mortgage loan originations but, for builders, it was a different story. Banking reforms aimed at deficiencies in bank real estate lending, and heightened scrutiny by examiners, banks became much more conservative about construction loans.

Builders, particularly those involved in multi-family projects, reported they had difficulty obtaining loans from thrifts and banks where they had established credit records. Multi-family builders reported it was almost impossible to get money from institutions where they weren't known.

Interest rates

Interest rates for fixed-rate home mortgages, which had soared to 13.8% as late as 1984 and held in the 10.5% to 10.75% range from 1987 to late 1990, dropped to 8.7% in late 1991. The drop continued to 8.23% early in 1992, then edged upward to 8.78% as billions of dollars worth of federal deficit-financing bonds hit the market.

Adjustable-rate mortgages (ARMs), which in 1984 seemed a bargain at 11.5%, also dropped to 8.36% in late 1990 and, by October, 1991, had slipped to 6.71%. They accounted for 23% of home mortgage originations at that time.

It appeared — at least from the point of view of sales — that consumers were sitting on their hands in the face of the lowest mortgage interest rates in nearly two decades. There was no corresponding spurt in new or existing home sales.

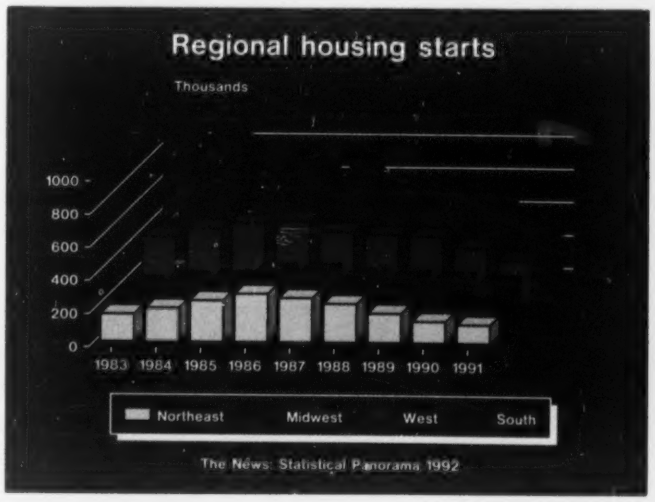
But there was plenty of action by those who had purchased mortgages at high rates in prior years. Even though refinancing accounted for only 35% of residential mortgage originations for the full year of 1991, it accounted for 65% of loan originations in the last three months of the year. Refinancing is expected to account for nearly 80% of mortgage originations in 1992.

While there appears to be plenty of money available for home mortgages, tighter credit restrictions are being applied. For example, banks and thrifts are telling refinance applicants that, if they don't have at least a 20% equity in their property, they needn't bother applying.

A relatively new phenomenon, the sale of property by auction, has sprung up in recent years. In 1987, auction sales totaled $80.7 million, according to Kennedy-Wilson, Inc. In 1991, auction sales totaled $796.2 million, an increase of 191% over the 1990 total of $398.5 million.

Heavily concentrated in California and the Northeast, clients include Resolution Trust Corp., large developers, financial institutions, syndicators, and industry. Types of property (with percent of total volume in parentheses) include: condominiums (38.1%); single-family homes (30.7%); residential lots (9%); commercial income properties (19.4%); land (2.5%); and mobile homes (0.3%).

Regional housing starts



The News: Statistical Panorama 1992

1992 forecast

It would appear that the long-suffering U.S. new home market hit bottom in 1991 — at least as far as single-family starts are concerned. But it would be a mistake to expect a sharp rebound like the nearly 700,000-unit increase in 1983 after the recession a year earlier.

Although credit availability, zoning problems, and even code compliance problems remain, we're confident of an upturn in new home starts. And while there is some pent-up demand in the single-family sector, it isn't nearly as strong as in the periods following prior recessions.

On balance, then, we expect total new home starts in 1992 of 1,200,000 units, an increase of 18.3% over the 1991 total of 1,014,700 starts.

Most of the increase will come from single-family home starts, which we expect will total 1 million units this year. That would be an 18.8% increase. We expect multi-family home starts to increase by 15.5% to 200,000 units this year, even though some would have us believe that this sector has not yet reached bottom.

NAHB, which researches the new home market as well as anyone, is more conservative. It is forecasting a new home start total of 1,185,000 for 1992, 985,000 single-family starts and 200,000 multi-family starts.

Looking ahead, NAHB sees better times. It forecasts that total starts in 1993 will amount to 1,424,000 units and, in 1994, starts will total 1.598,000 units.

The top 20

The top 20 single-family home markets for the first 10 months on 1991, as compiled by NAHB, include the number of building permits pulled for that period:

Atlanta 18,550; Washington, D.C. 12,710; Phoenix 11,870; Riverside-San Bernardino, Calif. 11,290; Minneapolis-St. Paul 10,450; Dallas 9,650; Detroit 9,590; Las Vegas 9,160; Houston 8,760; Philadelphia 8,280; Baltimore 8,050; Chicago 7,840; Orlando, Fla. 7,630; Tampa-St. Petersburg, Fla. 6,660; Sacramento, Calif. 6,590; Los Angeles-Long Beach 6,540; St. Louis 6,330; Seattle 6,090; Charlotte-Gastonia, N.C. 5,910; and Kansas City, Mo. 5,700.

The top 20 multi-family markets include:

Los Angeles-Long Beach 7,510; Las Vegas 5,100; Houston 3,630; Orlando, Fla. 3,440; New York 3,210; Seattle 2,930; Miami-Hialeah 2,870; Honolulu 2,810; Chicago 2,810; Riverside-San Bernardino, Calif. 2,600; Washington, D.C. 2,580; Oakland, Calif. 2,520; Anaheim-Santa Ana, Calif. 2,500; Detroit 2,450; Tampa-St. Petersburg, Fla. 2,430; San Diego 2,340; Milwaukee 2,290; Columbus, Ohio 2,110; Cincinnati, Ohio 2,110; Dallas, 2,080; and West Palm Beach-Boca Raton, Fla. 2,080.

(Page 12, Please)

LABOR

By all measures, 1991 was a poor year for the construction industry, a fact that was reflected in a lighter-than-normal load of collective bargaining agreements negotiated by union labor and employing contractors, according to the Construction Labor Research Council (CLRC).

Construction accounted for almost half of the decline in employment in the total economy, CLRC reported. The unemployment rate among construction workers ranged between 14% and 16%, up from 11% in 1990 and at its highest level since 1983.

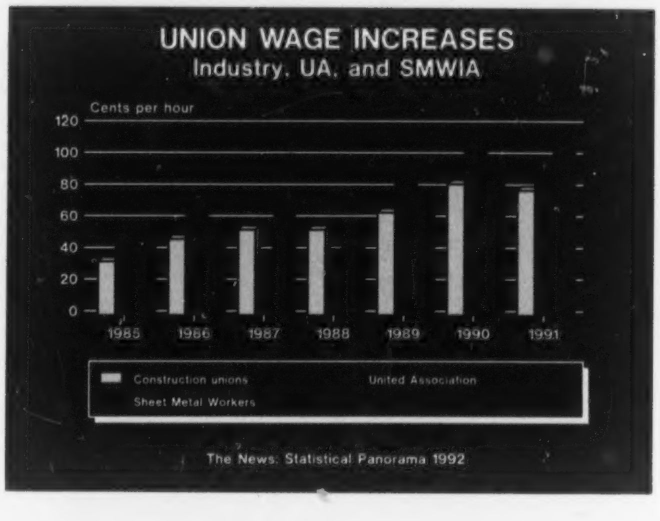
Settlements in both the first and second years of multi-year contracts were less than for 1990, reflecting a reversal of increasingly larger settlements in recent years, said CLRC. Contract durations also were shorter, regional differences were less, and craft variations widened.

Contracts negotiated last year resulted in an average first-year wage increase of 79¢/hour, or 3.4%, and 85¢/hour, or 3.6%, for the second year of multi-year contracts. It was the second year since 1982 that first-year settlements have averaged more than 3%.

The first-year settlement level represents a slight drop from the 1990 average of 83¢/hour, or 3.8%. The average for 1989 was 65¢/hour, or 2.9%. And the average for 1988 was 47¢/hour, or 2.2%.

The rise in later-year increases reflects a decline in the number of contracts containing wage freezes, and the virtual disappearance of rollbacks.

"A weak construction market and strong competition appear to have had an impact on bargaining results," said CLRC. "Especially in the Northeast, average increases were below those of the prior year."



Average settlements for the second and third years of 1991 multi-year agreements were down from the 90¢/hour, or 3.8%, negotiated in 1990, and were closer to first-year averages. Close to two-thirds were between 2% and 4%.

Of the average 79¢/hour first-year increase negotiated in 1991, higher wage rates accounted for 48¢. And, following a trend in recent years, a disproportionate part of the total (26¢) was added to health and welfare contributions. These health and welfare contributions increased by about 15% over rates in old agreements in

(Page 14, Please)

HOUSING AND CONSTRUCTION

(Continued from Page 10)

Demographics

The median age of a single-family detached home buyer in 1991 was 35.9 years, while the median age of a first-time home buyer was 31.2 years. The median age of trade-up home buyers was 39.8 years, while the median age of a single-family attached home was also 39.8 years.

In the case of single-family detached homes, 54.2% were bought by a husband and wife with children, 32.6% were bought by childless couples, 10.1% were bought by a single person, 1.5% were bought by a single person with children, and 1.7% were other sales. Of trade-up sales, 60.1% were bought by couples with children, 30% by childless couples, and 6.6% were bought by a single person.

The median income of buyers of single-family detached homes in 1991 was $57,569, up from $52,210 in 1990. The median income of buyers of single-family attached homes in 1991 was $52,703, up from $48,204 in 1990.

The percentage of households with two or more earners that purchased single-family detached homes increased in 1991 to 68% from 59.8% in 1988, and only 45.4% in 1976. Among households purchasing single-family attached homes last year, 54% had two or more earners.

Household formations is a critical measure in determining the longer-term demand for housing. Household formations, at 1.7 million/year in the 1970s, dropped to 1.3 million/year in the 1980s. In the 1990s, however, household formations fall further to 1.1 million/year.

Population growth is another factor. The Bureau of the Census predicts that the nation's population will grow at a rate of 2 million per year in the 1990s. In the first half of the decade, 60% will come from the existing population base and 40% will come from legal and illegal immigration. In the last half of the decade, it will be a 50%-50% split.

From these and from the shifts in age group numbers, it would appear that the average for new home starts in the 1990s will be in the range of 1.3 million units.

Those interested in the multi-family market keep a close eye on the under-25 age group, 84% of whom are renters. This group has declined by 1 million since 1986 and will decline by another million by the end of the decade.

The decline in the under-25 age group probably will be made up, in large measure, by immigrants who are accustomed to renting. This means an average demand for rental housing of about 450,000 units/year during the 1990s. Of these, about 30% will be single-family homes, 30% will be in structures with two to four units, and 40% will be apartment buildings with five or more units.

Looking at the age groups, the under-25 age group will add only 200,000 in the 1990s, the 25- 34-year age group will decline by 3.9 million, the 35- to 54-year age group will increase by 7.3 million, the 55- to 74-year age group will hold relatively steady, and the 75 and over group will increase by 2.8 million.

Other factors

The median price of a new home sold in October, 1991 was $122,500 and the average price was $149,400. Comparable prices in October, 1990 were $121,800 and $157,500. These figures reflect both a stabilization of prices and a shift toward more homes for first-time buyers.

The median price of existing homes sold in October, 1991 was $99,200 and the average was $126,500. Comparable prices in October, 1990 were $92,800 and $115,700.

The National Association of Realtors reported that 3,260,000 existing homes were sold in 1991, down a hair from the 3,329,600 existing homes sold in the previous year. The association expects 1992 sales will total 3,489,000 homes.

Of the 93,683,000 occupied housing units in the U.S., NAHB estimates that 727,000 are cooperatives and 3,204,000 are condominiums. NAHB reported that the condominium market now has an approximate 20% share of new home starts compared to a 40% share in the 1980s, primarily because it was concentrated in the now-distressed Northeast market.

NAHB reported that new home sales in 1991 totaled 500,000 units, the lowest level since 1982. The association expects 1992 new home sales to reach 575,000 units.

Mobile homes

Manufacturer shipments of mobile homes totaled 170,713 units in 1991, an 11.2% decline from the 192,300 mobile homes shipped in the previous year, according to the Manufactured Housing Institute (MHI).

Shipments of these site-delivered homes, popular with retired people and those with moderate incomes, are not counted in the official housing statistics.

In late years, mobile homes have accounted for about 20% of private single-family home starts, down from 36% in recession-ridden 1982. Last year, however, they accounted for only 16.8%.

A moderate recovery in the South in 1992 should push mobile home shipments back up to 190,000 units. Over the longer term, however, a declining pool of first-time home buyers should keep average shipments of mobile homes at about 200,000 units for the rest of the decade.

How existing U.S. homes are heated and cooled

According to the Bureau of the Census, there were 105,661,000 housing units in the U.S. in 1989. Of these, 2,881,000 were seasonal (vacation) homes, and 9,097,000 were vacant. This left 93,683,000 occupied homes. Of these, 59,916,000 (64%) were owner-occupied; 33,767,000 (36%) were occupied by renters.

Of the 93.7 million occupied homes in the U.S. in 1989, a total of 37,554,000 — or 40% — were equipped with central air conditioning. The penetration rises to 44.7% if we consider the 26,789,000 owner-occupied homes with central cooling. Only 10,765,000 renter-occupied homes, or 31.9%, are equipped with central air conditioning.

For the record, the Bureau of the Census also tells us that 612,000 of the 2.9 million seasonal (vacation) homes, and 3,255,000 vacant (for sale or rent) homes are equipped with central air conditioning. That makes a total universe of 41,420,000 central air systems, or 39.2% of all U.S. housing units.

Of the occupied homes, 34,367,000 (91.5%) of the central cooling systems are powered by electricity. Another 3,004,000 homes (8%) are gas-fired absorption systems. And 281,000 are powered by other means.

A 1987 Bureau of the Census study reported that 26,547,000, or 29.2% of the 90,888,000 occupied homes at that time, were equipped with one or more room air conditioners. Another 33,006,000 occupied homes (36.3%) had central air conditioning, and 31,335,000 homes (34.5%) were without any air conditioning.

Regionally, occupied homes without air conditioning ranged from 56.5% in the West, 46.9% in the Northeast, 33% in the Midwest, and only 13.7% in the South. Back in 1970, almost two thirds (64.2%) of occupied U.S. homes were without air conditioning of any kind.

Among the occupied homes in 1989, a total of 50,271,000 (53.7%) were equipped with a warm-air furnace as the main heating equipment, and 13,566,000 homes (14.5%) were heated with hydronic systems.

Heat pumps accounted for 6,875 homes, or 7.3%, and other built-in electric systems (resistance baseboard, ceiling cable) were installed in 6,658,000 (7.1%) of homes.

Floor, wall, or other built-in hot air units without ductwork accounted for 4,806,000 homes, or 5.1%. Another 11,506,000 homes, or 12.3%, use room heaters, stoves, and fireplaces as principal space heating sources.

In addition to the main heating equipment, another 29,563,000 occupied homes, or 31.6% of the total, use systems or appliances listed among the principal equipment as providers of secondary heat. Most use fireplaces, stoves, or room heaters, but 1,239,000 listed warm-air furnaces; 276,000 listed hydronic systems; 337,000 listed heat pumps; and 2,564,000 use built-in electric systems as secondary heat sources.

Of the total occupied homes, 23,060,000, or 24.6%, listed electricity as the main home space-heating fuel.

Natural gas accounted for 47,395,000 occupied homes, or 50.6% of the total. The fuel oil share was 12,469,000 homes, or 13.3%. And LP gas, with 3,664,000 homes, had a 3.9% share.

Kerosene accounted for 1,073,000 homes, or 1.2%; wood accounted for 4,586,000 homes, or 4.9%; coal for 335,000 homes, or 0.3%; solar for 40,000 homes; and other fuels for 168,000 homes.

It should be noted that 19,839,000 occupied homes, or 21.2% of the total, use more than one fuel. Chief among them were wood and electricity.

FUELS AND ENERGY

As a nation, U.S. energy consumption for the first 10 months of 1991 was 67.54 quadrillion Btu (quads), an increase of 0.17% over the 67.427 quads consumed during the same period in 1990, according to the Energy Information Administration (EIA).

To add some perspective, the nation's energy consumption for the full year of 1990, at 81.269 quads, was only 9.4% higher than the 74.282 quads consumed in 1973, the year of the OPEC oil embargo.

Energy consumption dropped somewhat after 1973, then grew to 78.898 quads in 1979, just after the second major oil price shock. It declined again during the 1982 recession, then built to 80.195 quads in 1988.

In the residential-commercial sector (EIA lumps them together), the 24.463 quads consumed during the first 10 months of 1991 were 1.9% more than the 23.996 quads consumed by this sector in the same period of 1990. The 1990 full-year total of 29.18 quads represented a 20.8% increase over the 24.143 quads used by the residential-commercial sector in 1973.

During the first 10 months of 1991, this sector represented a 36.2% share of total energy consumption. This was up 1% from the same period in 1990, and much higher than the 32.5% share in 1973.

Industrial consumption of 24.619 quads in the first 10 months of 1991 was 0.5% lower than the 24.759 quads consumed by that sector during the same period in 1990. The full-year 1990 total of 29.837 quads was 5.4% less than the 31.528 quads consumed by that sector in 1973.

During the first 10 months of 1991, the industrial sector accounted for a 36.5% share of total energy consumption, almost the same as in 1990. In 1973, the industrial sector consumed 42.4% of the nation's energy.

For the record, the transportation sector consumed 18.419 quads during the first 10 months of 1991, a 1.3% decline from the 18.669 quads consumed during the same period in 1990. It represented a 27.3% share of total energy consumption, about the same as in 1990. The share in 1973 was 25%.

The average price residential customers paid for No. 2 fuel oil, before taxes, was $1.258/gal in October, 1991, according to EIA (Energy Information Administration). That was the same price they paid a year earlier when the Gulf War caused a spike in fuel oil and kerosene (jet fuel) prices.

Electric utilities consumed 25.179 quads during the first 10 months of 1991, a 1.5% increase over the 24.806 quads consumed during the same period a year earlier. The 1990 full-year total of 29.582 quads was 49% more than the 19.582 quads consumed by electric utilities in 1973.

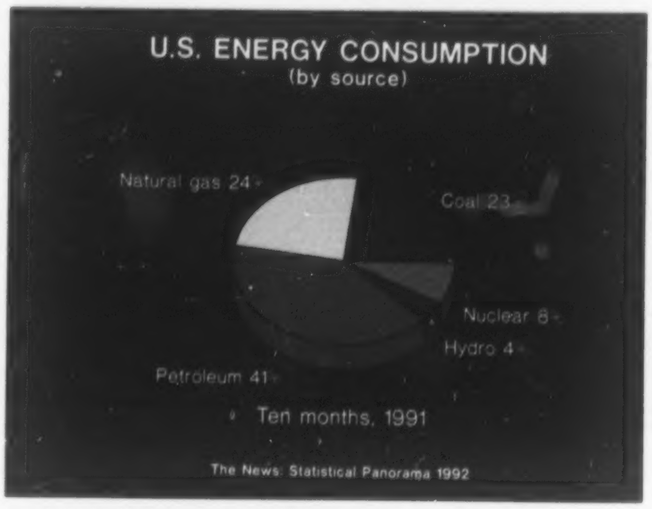
Of the 24.463 quads consumed by the residential-commercial sector during the first 10 months of 1991 (with the share for the same period in 1990 in parentheses), only 0.48% (0.51%) were coal; 23.7% (23.9%) were natural gas; 8% (8.6%) were petroleum; 21.3% (21%) were electricity; and 46.5% (46.4%) were electricity generation and transmission losses.

Similarly, the 24.619 quads consumed by the industrial sector during the first 10 months of 1991 breaks down this way: 8.5% (9.2%) were coal; 29.6% (28.8%) were natural gas; 27% (27.5%) were petroleum; 10.9% (10.8%) were electricity; and 23.8% (23.6%) were electricity generation and transmission losses.

Conservation

In order to get a gross measure of conservation, the Department of Energy records show that, in 1973, it took 22,700 Btu to generate each 1987 constant dollar of gross national product (GNP).

In the third quarter of 1991, it took 16,900 Btu to generate a 1987 constant dollar of GNP, or 25.6% less than in 1973. The third quarter of 1991 value was only slightly higher than the 16,600 Btu/dollar of GNP recorded in the third quarter of 1990.



The News' Statistical Panorama 1992

In simpler terms, the U.S. economy in the third quarter of 1991 produced at a rate of 4.863 trillion constant 1987 dollars' worth of goods and services, with 25.6% greater energy efficiency than in 1973.

Had it not been for that improvement, energy consumption for the first 10 months of 1991 would have been 84.83 quads instead of the actual 67.54 quads.

Fuel costs

The average price residential customers paid for No. 2 fuel oil, before taxes, was $1.258/gal in October, 1991, according to EIA. That was the same price they paid a year earlier when the Gulf War caused a spike in fuel oil and kerosene (jet fuel) prices.

The price of No. 2 fuel oil dropped to a low of 86.4¢/gal last summer.

From the previous peak of $1.194/gal in 1981, fuel oil prices declined gradually to 81.3¢/gal in 1988. Since that time, however, they have been increasing gradually. In 1978, before the second oil price shock, No. 2 fuel oil delivered to homes was only 49¢/gal.

The 10-month average price of natural gas delivered to residential customers in 1991 was $5.92/1,000 cu ft, a 1.4% increase over the $5.84/1,000 cu ft average for the first 10 months of 1990. These prices, according to EIA, include all taxes.

Gas prices reached a peak of $6.12/1,000 cu ft in 1984 and 1985, then declined to $4.63/1,000 cu ft in 1988. Since then, they have moved slowly upward. The 1991 average price was 359% higher than the $1.29/1,000 cu ft charged in 1973.

The average natural gas price charged commercial customers during the first 10 months of 1991 was $4.89/1,000 cu ft, a 1.7% increase over the $4.81/1,000 cu ft charged for the same period a year earlier. The 1991 average was 12.5% lower than the $5.59/1,000 cu ft peak price in 1983, but 420% higher than the 94¢/1,000 cu ft charged in 1973.

The 10-month average cost of natural gas for industrial customers in 1991 was $2.63/1,000 cu ft,

(Page 16, Please)

NCA (National Coal Association) said coal was used to generate 55.1% of the nation's electricity. Coal holds a 55% market share of utility fuel. A new phenomenon, the non-utility generator, is beginning to have an effect on electricity demand from conventional public utilities.

LABOR

(Continued from Page 12)

each of the last two years.

Health care

Union contractors in the construction industry will contribute an estimated $5 billion in 1992 to multi-employer health and welfare plans, CLRC reported. It's the single most expensive fringe benefit.

The current construction industry hourly contribution to health and welfare funds is $2.35/hour, an amount that has more than doubled in the last nine years. The health and welfare share of total wages and fringes has increased from just over 6% to just under 10%. Of the average increase of just over $6/hour since 1983, $1.20 has gone into health and welfare funds.

Of the average wage-and-fringe rate of $24.48/hour in 1992, 76.5% went for wages, 9.6% went for health and welfare, 8.3% went for pension contributions, and 5.6% went for other fringes.

The average health and welfare contribution for United Association (UA) plumbers and pipefitters is $2.53/hour, or 9.8%. The average for the Sheet Metal Workers' International Association (SMWIA) is $2.53/hour, or 9.5%.

CLRC said that frequently, in multi-year contracts, increases in the second and third year need to be reallocated to maintain health benefits. And, because many maintain eligibility for some time while unemployed, today's high unemployment rates mean declining fund income and higher claims.

CLRC said the primary reason for lower settlements nationally in 1991 was the drop in average increases for unions in New England, the Middle Atlantic states, and the Southwest Pacific region, where average first-year increases dropped by a minimum of 1.5% from 1990 levels. In 1990 the average first-year increase for these three regions was $1.12/hour; in 1991 it was 84¢.

Regional differences continue to diminish. Only the West North Central region — with the lowest of all increases — was more than 1% from the national average. The large East North Central region was the only one in which the average was above the national average.

Geographic differences appeared to play a larger role than intercraft variations. Six of the 11 crafts with reportable averages had lower percentage increases in 1991 than in the previous year.

CLRC reported that the uncertainty that has accompanied the weakness in the economy has resulted in shorter contract durations.

One-year agreements displaced three-year agreements as the most frequently negotiated and agreements for longer than three years, which began appearing in 1990, were rare. Only in the Middle Atlantic and East North Central regions were there a majority of multi-year agreements.

Of the 456 agreements negotiated in 1991, 412 contained wage increases. Of the total, 210 were one-year agreements; 246 were for more than one year.

UA and SMWIA

Of the 33 contracts negotiated last year by UA pipefitter and pipefitter-plumber locals, the average first-year settlement was 98¢/hour, or 3.9%. Of these, 19 agreements included a second-year average increase of 94¢/hour, or 3.6%.

Of the 35 agreements negotiated by SMWIA locals last year, the average first-year increase was $1.02/hour, or 3.9%. And, unlike the previous year, SMWIA negotiated 19 multi-year agreements with an average second-year increase of 95¢/hour, or 3.8%.

Service rates

Thus far, we have only dealt with union shops, where wage rate information is more readily available. Data for open shops, which account for about 80% of the nation's hvac contractors, is more difficult to obtain.

A survey of *News* readers published Nov. 4, 1991 revealed that the disparity between union and open shop contractors remains strong. Nearly 40% of union contractors pay $30/hour or more, while only 4% of open shop contractors do. At the other end of the spectrum, 18% of nonunion contractors pay $13/hour or less, while only 6% of union contractors do.

Overall, the median basic charge-out rate was $42/hour. The median payroll labor cost (including fringe benefits) was $17.63/hour.

FUELS AND ENERGY

(Continued from Page 14)

a 9% decline from the $2.89/1,000 cu ft average for the same period in 1990. The 1991 price was 37.7% lower than the peak price of $4.22/1,000 cu ft charged in 1984, but 426% higher than the 50¢/1,000 cu ft charged in 1973.

The 10-month average cost of electricity for residential customers in 1991 was 8.1¢/kWh, a 2.5% increase over the 1990 average of 7.9¢/kWh for the same period. Electricity prices have risen steadily over the last dozen years, but the increase has been less than 13% since 1983. However, the 1991 average was 224% higher than the 1973 rate of 2.5¢/kWh.

The average price utilities charged commercial customers for the first 10 months of 1991 was 7.5¢/kWh, up slightly from the 7.4¢/kWh charged for the same period a year earlier. The 1991 average was the same as the 1985 rate. The average dipped to 6.9¢/kWh in January, 1989, but climbed thereafter. It was 212% higher than the 2.4¢/kWh charged commercial customers in 1973.

Similarly, the average price paid by industrial customers for the first 10 months of 1991 was 4.9¢/kWh, up a hair from the 4.8¢/kWh average for the same period in 1990. The 1991 price was 5% lower than the peak price of 5.19¢/kWh paid in 1985, but 277% higher than the 1973 average of 1.3¢/kWh.

Nuclear

In October 1991, U.S. nuclear generating units produced a net total of 48 billion kWh of electricity, 10% more than in the same month a year earlier, according to EIA.

Nuclear units generated at an average capacity factor of 64.2%, or 6% more than in October, 1990. Nuclear power supplied 21.4% of the total electric utility-generated electricity last October, up from 19.3% in October, 1990.

As of Oct. 31, 1991, there were 111 operable nuclear generating units in the U.S. with a collective net summer capability of 99.6 million kW of electricity. Of the total, 28 units generated at less than 25% of capacity because of maintenance, refueling, or repair outage. Of those, 19 units generated no electricity during the month.

Four units with full-power licenses have been shut down by the Nuclear Regulatory Commission. Only two nuclear power plants are actively under construction.

Electricity sales

Electricity sales to ultimate customers, at 2,314,953 million kWh for the first 10 months of 1991, were up 1.8% from the year-previous 10-month total of 2,274,773 million kWh. Total sales in 1973 amounted to 1,712,909 million kWh.

Of the 2,366,956 million kWh generated during the first 10 months of 1991 (with comparable 1990 percentages in parentheses), 54.4% (55%) came from coal; 9.7% (9.8%) came from natural gas; 4% (4.4%) came from petroleum; 21.7% (20.4%) came from nuclear units; 9.9% (10%) came from hydroelectric installations; and 0.35% (0.38%) came from other sources.

Of the 2,314,953 million kWh sold in the first 10 months of 1991, residential sales (with a 34.7% share) totaled 803,964 million kWh, up 3.4% from the 777,179 million kWh sold during the same period a year earlier.

Commercial sales (with a 27.8% share) totaled 643,381 million kWh for the 1991 period, up 1.6% from the 633,406 million kWh for the same period in 1990.

The U.S. economy in the third quarter of 1991 produced at a rate of 4.863 trillion constant 1987 dollars' worth of goods and services, with 25.6% greater energy efficiency than in 1973.

Industrial sales (with a 33.9% share) totaled 786,209 million kWh for the 10-month 1991 period, up 0.1% from the 785,109 million kWh for the same period in 1990. Other sales (with a 3.5% share) totaled 81,400 million kWh for the 1991 period, up 2.9% from the 79,079 million kWh total for the same period in 1990.

The net summer generating capability of the electric utility industry at the end of the third quarter of 1991 was 693,350 megawatts (MW), up 0.8% from the net of 687,984 MW at the same time a year carlier, according to the Edison Electric Institute (EEI).

Similarly, the net winter generating capability at the end of the third quarter of 1991 was 705,278 MW, also up 0.8% from the 699,495 MW for the same time a year earlier.

EEI reported that electric utility output in the contiguous 48 states for the 52 weeks ended Dec. 28, 1991 was 2,959,164 million kWh, an increase of 2.3% over the 2,891,442 million kWh recorded for the same period in 1990.

The average number of electric utility customers at the end of the third quarter of 1991 was 110,295,000, up 0.8% from the 109,202,000 total at the same time a year earlier.

The 10-month average price of natural gas delivered to residential customers in 1991 was $5.92/1,000 cu ft, a 1.4% increase over the $5.84/1,000 cu ft average for the first 10 months of 1990. These prices, according to EIA, include all taxes.

Natural gas

Gas utility thermal equivalent sales in 1991 (based on 11 months actual and one month estimated) totaled 9,775.8 trillion Btu, down 0.7% from the 1990 actual total of 9,846.2 trillion Btu, according to the American Gas Association (AGA).

The total for 1991 represents a 22.5% drop from the 1985 total of 12,615 trillion Btu.

Residential sales (46.6% of the total) in 1991 amounted to 4,553.2 trillion Btu, up 1.8% from the 1990 total of 4,471.5 trillion Btu. The residential sector had a 39.4% share in 1986.

Commercial sales (with a 22.6% share) in 1991 amounted to 2,210.1 trillion Btu, up 0.8% from the 1990 total of 2,193.2 trillion Btu. Industrial sales (19% of the total) amounted to 1,857.5 trillion Btu in 1991, down 1.7% from the year-previous total of 1,890.5 trillion Btu. The industrial sector's share of the total was 26% in 1986.

Electricity generation sales (9.9% of the total) in 1991 amounted to 971.2 trillion Btu, down 13.3% from the 1990 total of 1,120.1 trillion Btu. The "other" category (1.9% of the total) accounted for 183.8 trillion Btu in 1991, up slightly from 170.9 trillion Btu in 1990.

AGA reported that the November, 1991 average natural gas utility price was $4.597/million Btu, an increase of 3.1¢/million Btu over the $4.566/million Btu average for the same month of 1990.

Prices for specific markets in November, 1991 (November, 1990 prices in parentheses) averaged $5.656/million Btu ($5.543) for the residential sector; $4.821 million Btu ($4.828) for the commercial sector; $3.009/million Btu ($3.181) for industrial customers; and $2.437/million Btu ($2.609) for electric utilities.

It should be noted that the excess natural gas production capability — the gas "bubble" — that has been a fact of life since 1980 has been virtually eliminated.

During a cold winter, AGA said the gas industry would use all available production, plus storage and imports, to meet demand. The winter of 1991-1992, however, promises to be the warmest on record.

The gas bubble grew steadily from 1980 to a high of 4,176 billion cu ft in 1985, then declined to 223 billion cu ft in 1990. Market growth is only partly responsible for the decline.

AGA reports that reduced drilling activity, coupled with a decline in production per gas well, were other contributing factors.

Exploration

Total oil and gas well completions during the first 11 months of 1991 amounted to 24,890 wells, down 7.9% from the 27,020 wells drilled during the same period in 1990.

Both years were dramatically lower than the 90,030 wells completed in the peak year of 1981.

Oil well completions for the first 11 months of 1991 totaled 10,540, down 0.8% from the 10,630 oil well completions in the same period of 1990. Gas well completions for the first 11 months of 1991 totaled 8,020, down 11.5% from the 9,060 gas wells completed in the same period a year earlier.

The remaining 6,330 were dry wells (down 13.6%) which, at 25.4% of the total, were less than the 31% average for the prior decade.

Total footage drilled during the first 11 months of 1991 amounted to 118,590 million ft, down 7.9% from the total of 129,180 million ft drilled in the same period of 1990.

In 1991, the weekly average of rotary drilling rigs in operation was 860, down 14.7% from the 1990 weekly average of 1,008 rigs. Of the 1991 total, 81 rigs (9.4%) were drilling offshore (down 25%), and 779 rigs (90.6%) were drilling on land (down 13.4%).

The monthly average of crews involved in seismic exploration in 1991 was 104, down 16.8% from the monthly average of 125 crews in 1990. Of the seismic crews in 1991, land crews accounted for 81.7% and offshore crews accounted for 18.3%.

Imports

U.S. net imports of energy for the first 10 months of 1991 totaled 11.018 quads, a decline of 9.9% from the 12.23-quad total for the same period in 1990. This amounts to 16.3% of domestic consumption.

Put another way, the U.S. produced 83.7% of all the energy it consumed during the first 11 months of 1991.

Of the 11.018 net quads for the first 10 months of 1991, crude oil accounted for 10.32 quads, or 93.7%. It was down 4.8% from the 10.843 quads of net petroleum imports for the same period in 1990.

Petroleum products, at 1.482 quads for the first 10 months of 1991, were down 40% from the 1990 same-period total of 2.467 quads. They accounted for 13.5% of total net imports in 1991.

Natural gas net imports for the 11-month 1991 period totaled 1.305 quads (11.8% of the total), a 10.8% decline from the 1990 same-period total of 1.177 quads. And coal, with a net export total of 2.26 quads for the first 11 months of both 1990 and 1991, had a positive effect on the total — and our arithmetic.

Significantly, the U.S. was importing petroleum in the third quarter of 1991 at a rate of 7.168 million barrels/day, or 42.4% of all petroleum products supplied (16.918 million barrels/day). This represents a 4.6% decline from the net import total of 7.512 million barrels/day rate in the third quarter of 1990, which amounted to 43.9% of all petroleum products supplied (17.223 million barrels/day).

Of the 1991 net import rate of 7.168 million barrels/day, the Arab members of OPEC (Organization of Petroleum Exporting Countries) supplied 2.026 million barrels/day, or 12% of total petroleum supplies; other OPEC countries (Ecuador, Gabon, Indonesia, Nigeria, and Venezuela) supplied 4.217 million barrels/day, or 24.9% of total petroleum supplies.

Coal

The U.S. coal industry produced 998 million tons of coal in 1991, down 3% from the record 1.029 billion tons produced in 1990, according to preliminary figures released by the National Coal Association (NCA).

Production this year, however, is expected to increase by 3.1% to equal 1990's record performance.

Total consumption in 1991 equaled the record total of 1.001 billion tons set in 1990. But a 2.5% increase this year could set a new record for consumption of 1.026 billion tons.

The Economics Committee forecast that 1991 domestic consumption will total 892 million tons, down slightly from the 895 million ton total in 1990. Domestic consumption is expected to increase by 2.2% in 1992 to a record 912 million tons.

Electric utilities consumed 776 million tons of coal in 1991, up 0.5% from the 772 million tons consumed by utilities in 1990. Utility consumption is expected to increase by 2.3% in 1992 to 794 million tons.

NCA said coal was used to generate 55.1% of the nation's electricity. Coal holds a 55% market share of utility fuel.

A new phenomenon, the non-utility generator, is beginning to have an effect on electricity demand from conventional public utilities.

This market has grown from 40 million kWh in 1985 to approximately 116 million kWh in 1990, or 4% of electric power generation. It is an especially important factor in the New England, West South Central, and Pacific regions.

Consumption of coking coal, at 34 million tons in 1991, was down 15% from the 40 million-ton total in the previous year because of a 12% drop in domestic steel production. It's expected to grow by 5.9% this year to 36 million tons.

Industrial and retail sales, at 82 million tons in 1991, were down by one million tons from 1990 and expected to stay flat this year.

Coal exports grew by 5.8% in 1991, from 91 million tons in 1990 to 96 million tons last year. Expect a 4.6% improvement in 1992 to 99 million tons because of an expanding world market for both steam and metallurgical coal.

Imports of coke in 1991 totaled one million tons, down from three million tons in 1990. Other imports remained constant at three million tons.

Of the 998 million tons of coal produced in the U.S. last year, 592 million tons (or 59.3%) were produced in the East and 406 million tons (40.7%) were produced in the West.

Production in the East is expected to increase by 2.87% this year to 609 million tons. The expected 3.7% increase in production in the West will bring that total to 420 million tons.